Series 1955, No. 12

Issued February 1966

# SOIL SURVEY

# Prineville Area Oregon

OUR SOIL * OUR STRENGTH

This is the last report of 1955 series

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Oregon Agricultural Experiment Station

# HOW TO USE THIS SOIL SURVEY REPORT

THIS SOIL SURVEY of the Prineville Area, Oreg., contains information that can be applied in managing farms, ranches, and rangeland; in selecting sites for roads, ponds, buildings, and other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

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### Locating Soils

All the soils of the Prineville Area are shown on the detailed map at the back of this report. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the report. This guide lists all the soils of the Area in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

*Farmers, ranchers, and those who work with them* can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretative groupings.

*Engineers and builders* will find under "Use of Soils in Engineering" tables that give engineering descriptions of the soils in the Area and that name soil features that affect engineering practices and structures.

*Scientists and others* can read about how the soils were formed and how they are classified in the section "Formation, Classification, and Morphology of Soils."

*Students, teachers, and others* will find information about soils and their management in various parts of the text.

*Newcomers in the Prineville Area* may be especially interested in the section "General Soil Map" where broad patterns of soils are described. They may also be interested in the section "Facts About Crook County," which gives additional information.

* * * * *

Fieldwork for this survey was completed in 1955. Unless otherwise indicated, all statements in the report refer to conditions in the Area at the time the survey was in progress. This soil survey of the Prineville Area is a cooperative survey made by the Soil Conservation Service and the Oregon Agricultural Experiment Station.

U.S. GOVERNMENT PRINTING OFFICE: 1966

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402

# Contents





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# SOIL SURVEY OF THE PRINEVILLE AREA, OREGON

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FIELDWORK BY GEORGE K. SMITH AND HAROLD BIGGERSTAFF, SOIL CONSERVATION SERVICE, AND ELWOOD DULL, OREGON AGRICULTURAL EXPERIMENT STATION

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE OREGON AGRICULTURAL EXPERIMENT STATION

THE PRINEVILLE AREA lies between the Cascade and the Ochoco Mountains in the central part of Oregon. It occupies about 275 square miles of Crook County (fig. 1). Prineville, the county seat, is in the western part of the county and is near the center of the Area.

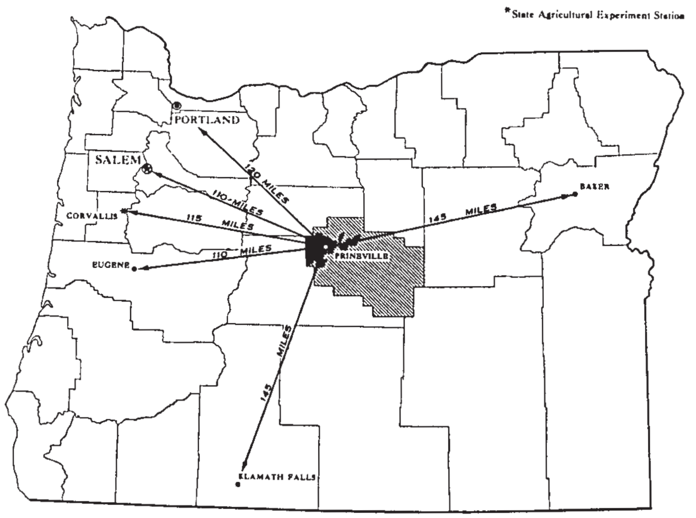


*Figure 1.*—**Location of the Prineville Area (shown in black) in Crook County, Oregon.**

The Prineville Area is drained by the Crooked River and its tributaries, Ochoco, McKay, Lytle, Johnson, and Mill Creeks. The Ochoco Reservoir, formed by damming Ochoco Creek just below its confluence with Mill Creek, controls flooding and is the only place available in the Area for storing irrigation water in quantity. In addition, streamflow is used for irrigation by diverting water at several dams built on other creeks. Alluvial flood plains occur mainly along Ochoco Creek and the Crooked River and range from ½ to 1 mile in width.

Climate in the Area is semiarid, though winter is cold and moist. In summer the days are warm but the nights are cool, and frost has been recorded in every month. In general, the annual precipitation increases with elevation northward and eastward from Prineville. It is about 9 inches at Prineville and about 18 inches at the Ochoco Ranger Station.

## *How Soils Are Mapped and Classified*

Soil scientists made this survey to learn what kinds of soils are in the Prineville Area, where they are located, and how they can be used.

They went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the Area, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Deschutes and Ochoco, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Deschutes sandy loam and Deschutes loamy sand are two soil types in the Deschutes series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature

affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Deschutes sandy loam, 0 to 2 percent slopes, is one of several phases of Deschutes sandy loam, a soil type that ranges from nearly level to moderately steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Searles-Slayton complex, 2 to 20 percent slopes.

In a few places it is desirable to show two or more soil types or soil phases, which are similar but do not regularly occur together, as one mapping unit. Such groups are called undifferentiated soil groups. They are named in terms of their constituent soils and connected by "and." Ayres and Ochoco sandy loams, 0 to 2 percent slopes, is an example of an undifferentiated soil group.

In addition, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Rock land or Riverwash, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. On the basis of the yield tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## *General Soil Map*

After studying the soils in a locality and the way they are arranged, a soil scientist can make a general map that shows the main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic though not strictly uniform.

The soils within any one association are likely to differ in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map does not show the kind of soil in any particular place, but patterns of soils, in each of which are several different kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general map is useful to people who want a general idea of the soils, who want to compare different parts of the survey area, or who want to learn the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The Prineville Area lies in the Columbia Plateau province in north-central Oregon. Soil associations 1, 2, 3, and 5 are on flood plains, terraces, low benches, and alluvial fans. They contain soils that formed mainly in sediments deposited by streams. Soil associations 4 and 9 occur on the basaltic plateau and consist of soils with hardpan, soils formed from pumiceous material, and shallow, stony soils. Soil associations 6, 7, and 8 are on uplands and on buttes and hills, but the soils in associations 6 and 8 formed in material derived from rhyolite rock and tuff, whereas those in association 7 formed mainly in basaltic material.

### 1. Polly-Veazie-Ontko association: Soils on flood plains and alluvial fans in narrow valleys

This association is in the narrow valleys (fig. 2) of Mill Creek, upper McKay Creek, and Ochoco Creek above Ochoco Reservoir. It occupies about 3 percent of the survey area.

The Polly soils, which make up about 35 percent of the association, are on alluvial fans above the flood plain and below the steep uplands. Slopes of the Polly soils range from 0 to 20 percent. The well-drained Veazie soils are on the nearly level flood plain and cover about 35 percent of the association. The poorly drained and very poorly drained Ontko soils also are on the nearly level flood plain and occupy about 20 percent of the association. Veazie and Ontko soils are frequently flooded for short periods in spring. In the remaining 10 percent of the association are the well-drained Steiger sandy loam and other alluvial soils.

The Polly soils have a dark-gray or grayish-brown loam to sandy loam surface layer, which is gravelly or

***Figure 2.*—Irrigated soils in a narrow valley, Polly-Veazie-Ontko soil association.**

stony in places, and a grayish-brown to reddish-brown clay loam subsoil. The surface layer of the Veazie soils is dark-gray loam to gravelly sandy loam that is underlain by layers similar to it except for their grayish-brown color. Very gravelly or sandy underlying material occurs at a depth of 18 to 40 inches. Ontko soils have a neutral clay loam or clay surface layer that is black when moist. The subsurface layer is similar but is mottled. A substratum of stratified silty clay loam to loamy coarse sand occurs below a depth of about 2 feet. Although roots easily penetrate the substratum, their growth is hindered by a water table that fluctuates between the depths of 18 and 36 inches during much of the year. Steiger sandy loam is an ashy, pumiceous soil with a grayish-brown surface layer and brown to pale-brown lower layers. This soil is easily penetrated by roots to a depth of 5 feet or more.

Most of this association is irrigated and is used mainly for hay crops and as summer pasture for beef cattle. Some of the acreage of Polly soils is dryfarmed to small grain. Chiefly because of wetness and the frost hazard, the association generally is not well suited to potatoes. If the soils are well irrigated and are adequately drained, they produce good forage in summer. Except on the poorly drained Ontko soils, fair yields of alfalfa are produced under irrigation.

### 2. Powder-Boyce-Metolius association: Soils on flood plains and low benches in broad valleys

This association occupies the nearly level flood plain and low benches along the Crooked River and its major tributaries (fig. 3). It amounts to about 11 percent of the survey area. In many places, particularly south and west of Prineville, the association is adjoined by steep canyon walls.

About 35 percent of the association is well-drained Powder soils, 15 percent is poorly drained or very poorly drained Boyce soils, and 20 percent is well-drained or somewhat excessively drained, pumiceous Metolius soils. About 15 percent consists of the sandy Crooked soils, which are sodic, or alkali, and the remaining 15 percent is mainly Riverwash and Stearns and Forester soils.

Powder soils are loamy, moderately deep to very deep over sand and gravel, and generally calcareous below a depth of 1 to 2 feet. The Boyce soils lie in depressional areas below the Powder soils and are mottled from surface to substratum. Metolius soils have a surface layer of light brownish-gray sandy loam, loamy sand, or loam and a subsoil of sandy loam or loamy sand. The Metolius soils are underlain by gravel and sand, generally at a depth of 6 feet or more. The Crooked soils, like the Metolius soils, were derived mainly from pumice. Crooked soils have a light brownish-gray loamy sand to loam surface layer

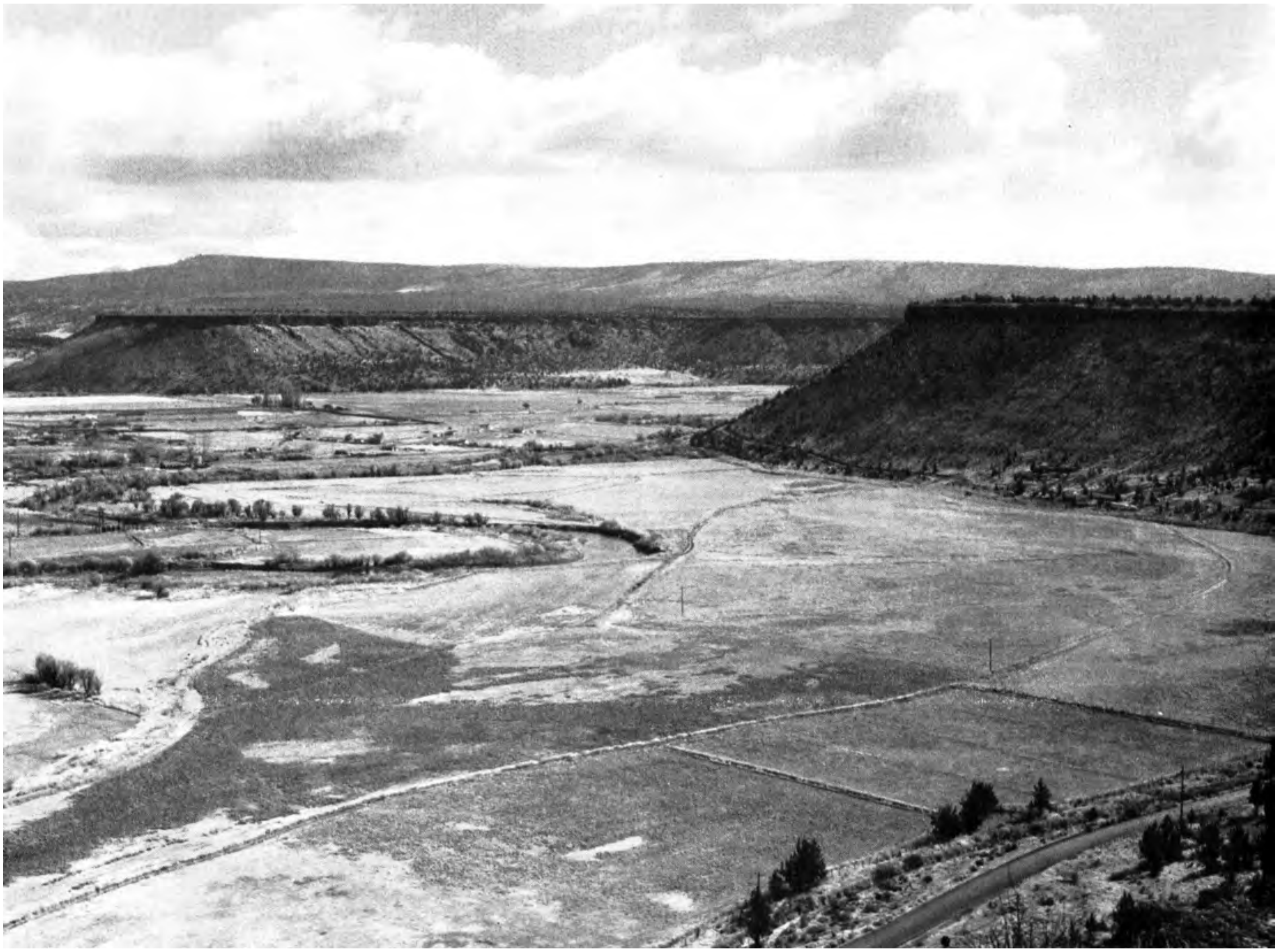

*Figure 3.*—**Landscape in the Powder-Boyce-Metolius soil association showing valley of the Crooked River in the foreground and valley of Ochoco Creek at extreme left. Patchy stand of alfalfa is on Crooked soils, which are sodic, or alkali.**

that is very strongly alkaline and slightly calcareous. In many places the subsoil is higher in alkali content than the surface layer. A strongly cemented hardpan occurs at a depth of 12 to 36 inches.

Minor components of this association are Riverwash, Stearns soils, and Forester soils. Riverwash consists mostly of barren, unstable sand and gravel along the Crooked River and smaller streams. The Stearns soils have a silt loam surface layer and generally a silty clay loam subsoil. The content of exchangeable sodium in Stearns soils is medium to high in the surface layer and is even higher in the subsoil. Forester soils are like Crooked soils but do not have a hardpan.

Most of this association is used for irrigated crops, principally hay and pasture for beef cattle. The Metolius, Powder, and other well-drained soils also are used for potatoes and other row crops. The other soils generally are not well suited to potatoes, mainly because of imperfect drainage or alkali. Boyce soils are commonly too wet for alfalfa, and the Stearns soils are too strongly affected by alkali for good yields of that crop. The Crooked and Forester soils are suited to alfalfa, though productivity is lowered by alkali. On Crooked and Forester soils the yields of alfalfa can be increased by using practices that reduce the accumulation of alkali. The other soils in the association produce good yields of alfalfa. Improved pasture can be grown on nearly all the soils by selecting suitable grasses and legumes, reducing the alkali content where necessary and feasible, providing adequate drainage, and irrigating the soils properly.

Most of the city of Prineville is on this association, mainly on Stearns and Crooked soils. Although some of the residential acreages around Prineville are farmed part time, most of the agriculture is on large ranches.

### 3. Ochoco-Prineville-Courtrock association: Soils on terraces and broad alluvial fans

This association occupies about 11 percent of the Prineville Area and occurs in four separate areas north of lower Ochoco Creek and the Crooked River. About two-thirds of the association is on slopes of 6 percent or less. The general relief is that of a nearly level or gently sloping

terrace that is interrupted in places by shallow drainageways and terrace escarpments. Slopes of these escarpments range from 6 to 40 percent but generally are 12 to 20 percent. Above the terrace lie broad alluvial fans.

About 40 percent of the association is well-drained Ochoco soils, 35 percent is well-drained Prineville soils, and 10 percent is Courtrock soils. The rest is chiefly Ayres and Slayton soils.

The Ochoco and the Prineville soils occur on terraces and terrace escarpments. Ochoco soils have a surface layer of light brownish-gray to grayish-brown loamy sand, sandy loam, or loam that is gravelly in places. Their subsoil commonly is gravelly sandy clay loam and is underlain, at a depth of 20 to 36 inches, by a weakly to strongly cemented hardpan. Except for their fine sandy loam subsoil, the Prineville soils are similar to the Ochoco soils. The Courtrock soils lie on alluvial fans, are light brownish gray, and do not have a hardpan.

The Ayres soils in this association occur on terrace escarpments. These soils are like the Ochoco soils but are 12 to 20 inches deep to hardpan. Slayton soils occupy low foothills and are underlain by bedrock at a depth of 8 to 20 inches.

Most farms on this association are irrigated and diversified. Raising beef cattle and growing potatoes are the main enterprises, though some dairy herds and flocks of sheep are kept. The soils generally are among the most productive of the survey area. Except for those on terrace escarpments and in wet drainageways, these soils are well suited to all crops commonly grown, and few problems arise in their management. Properly managing irrigation water is the chief concern.

Some of the association is dryfarmed to small grain that is used mostly as hay for cattle. A small acreage is in pasture and range. The northern part of the city of Prineville is on this association.

### 4. Deschutes-Redmond-Bakeoven association: Soils from pumiceous material and shallow, stony soils on the basaltic plateau

This association occurs on the basaltic plateau west and south of the Crooked River and westward to the Deschutes County line. It is the largest association in the survey area and makes up about 30 percent of the total acreage. The Dry River, flowing from south to north, passes through the major part of the association and empties into the Crooked River. Several smaller areas are east of the community of Powell Butte. In most places the relief is gentle, but west of the Dry River the gentle slopes are broken by small mounds or knolls of basalt rock and by long, narrow ridges of bare basalt (*4, 8*).[1] These mounds and ridges generally rise 5 to 25 feet above the general terrain. East of the Dry River they occur in only a few places.

Most extensive are the Deschutes soils, which make up about 45 percent of the association. Redmond soils cover about 25 percent, and Bakeoven soils 20 percent. In the remaining 10 percent are Rock land, Rock outcrop, and Swartz silt loam.

Deschutes soils are light brownish-gray sandy loams and loamy sands that are 18 to 54 inches deep to a substratum that is basalt bedrock in most places. The grayish-brown, pumiceous Redmond soils have a loam to clay loam subsoil and are 16 to 36 inches deep over bedrock. The grayish-brown, very stony Bakeoven soils were derived mainly from basalt. Rock land consists of rock outcrops and areas of shallow, stony Deschutes or Bakeoven soils. Swartz silt loam occupies basins with no outlets and is imperfectly drained; it has a clay or silty clay subsoil.

Three-fourths or more of this association is range, and most of the rest is irrigated. All crops grown in the survey area are suited to the Deschutes and Redmond soils that are nonstony and have slopes of not more than 6 percent. Most of the diversified irrigated farms in the association are on these soils in the vicinity of Powell Butte. Along the Dry River, in the southwestern part of the association, is a small irrigated area that consists of Deschutes and Redmond soils and the alluvial Metolius soils. Water wasted in the irrigation of other crops is used to produce pasture on the stony Deschutes soils and the very stony Bakeoven soils.

The main farming enterprises are raising beef cattle, producing potatoes, and dairying. A few flocks of sheep are kept. Nearly all the area west of the Dry River is in range, most of which is overgrazed and in poor condition. The plant cover in this area is dominated by juniper, sagebrush, and rabbitbrush. Some of the acreage could be irrigated if water were available, but areas of Rock land and Rock outcrop would make the distribution of water difficult.

### 5. Ayres-Ochoco-Deschutes association: Soils with hardpan on alluvial fans and soils from pumiceous materials

This association makes up about 11 percent of the survey area and lies at the foot of the Powell Buttes (fig. 4), which rise to an elevation of more than 5,000 feet. In this association are alluvial fans consisting of soil materials that came from the Powell Buttes and were derived from rhyolite. The Ayres and Ochoco soils formed in these materials. The alluvial fans are on slopes of 0 to 12 percent, are most strongly sloping just below the buttes, and are nearly level at the lower end, or toe. In most places they are 1 to 2 miles long. No perennial streams pass through this association.

About 70 percent of the association consists of Ayres and Ochoco soils. About 25 percent is occupied by the Deschutes soils, which are mostly moderately deep or deep over hardpan. The remaining acreage is chiefly Searles and Bakeoven soils.

The Ayres soils have a surface layer of light brownish-gray sandy loam that is gravelly or stony in many places. Their subsoil is gravelly or stony clay loam and is underlain by an indurated gravelly hardpan at a depth of 12 to 20 inches. The Deschutes soils are light brownish-gray, pumiceous sandy loams and loamy sands that are underlain, in some places, by soil material that is like an Ayres soil or, in other places, by gravel that washed from the buttes in intermittent streams. The Ochoco soils are similar to the Ayres soils but are 20 to 36 inches deep to hardpan. Searles soils are light brownish-gray to grayish-brown, stony soils that developed in material derived from rhyolite or tuff bedrock. The very stony Bakeoven soils were derived mainly from basalt bedrock.

Much of this association lies above existing canals and is not irrigated. Most areas below the canals are irrigated and are used mainly for potatoes and for hay and pasture

[1] Italic numbers in parentheses refer to Literature Cited, p. 87.

*Figure 4.*—Irrigated pasture on Ayres, Ochoco, and Deschutes soils that occupy an alluvial fan at the base of the Powell Buttes in the Ayres-Ochoco-Deschutes soil association. Buttes in the background are in the Searles-Elmore soil association.

for beef cattle. Yields generally are good, though in places where the soils are sloping and of limited depth, leveling and irrigating are fairly difficult.

Some areas above irrigation canals were formerly dryfarmed to wheat and then abandoned. Of these abandoned areas, some were seeded to crested wheatgrass that formed good stands, and others were invaded by cheatgrass, rabbitbrush, and some sagebrush. A few dryland areas are now cultivated, principally to rye that is used mainly as hay for beef cattle.

### 6. Searles-Elmore association: Soils from rhyolite rock on buttes and hills

This association occurs on the Powell Buttes and in the area of Barnes Butte northeast of Prineville. It covers about 4 percent of the survey area. Slopes range from 2 to 40 percent but are 20 to 40 percent in most places. The soils were derived mainly from rhyolite.

About 60 percent of the association consists of the stony Searles soils, and 20 percent consists of Elmore very stony loam, 6 to 40 percent slopes. Rock land and Rock outcrop make up about 15 percent, and the Ayres and Ochoco soils account for most of the rest.

In most places the Searles soils have a surface layer of light brownish-gray to grayish-brown stony loam, stony clay loam, or stony sandy loam. Generally, their subsoil is stony or gravelly clay loam and overlies rhyolite bedrock at a depth of 16 to 40 inches. Most of the acreage in Searles soils is on south-facing slopes. The Elmore soil typically has a grayish-brown surface layer and a clay loam subsoil over rhyolite bedrock at a depth of 2 to 5 feet. This soil commonly occupies north-facing slopes. Rock land and Rock outcrop occur principally with the Searles soils. The Ayres soils have a light brownish-gray surface layer and a gravelly or stony clay loam subsoil over an indurated gravelly hardpan at a depth of 12 to 20 inches. The Ochoco soils are like the Ayres soils but are 20 to 36 inches deep to hardpan.

Almost all of this association is used for pasture and range. A few small areas of Ayres and Ochoco soils are dryfarmed, mainly to small grain that is grown for hay and fed to cattle. On the Elmore soil the plant cover consists of bunchgrasses—chiefly Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass—and sagebrush, rabbitbrush, and juniper. Except for Idaho fescue, these plants also make up most of the cover on the Searles soils. The Elmore soil, however, generally has denser stands of bunchgrasses and provides better grazing in summer than the Searles soils, which are most suitable for grazing in spring and fall.

### 7. Gem-Lookout-Agency association: Soils mainly from basaltic material, on uplands

This association occurs in eight individual areas of the Prineville Area and makes up about 19 percent of the total acreage. It is characterized by steep or very steep topography, but small parts have milder slopes. The pattern of drainage is well defined.

About 20 percent of the association is Gem soils, 25 percent is Lookout soils, and 20 percent is Agency soils.

Rock land and Bakeoven soils account for about 20 percent. The rest consists mainly of Salisbury, Deschutes, and Redmond soils, and there is a small acreage of Day clay.

The stony Gem soils have a grayish-brown loam or clay loam surface layer and a clay loam subsoil. These soils are underlain by basalt bedrock at a depth of 1 to 3 feet. The Lookout soils were derived from basalt; they have a light brownish-gray loam surface layer, a clay loam subsoil and, at a depth of 18 to 36 inches, a strongly cemented hardpan. Most of the acreage in Lookout soils is very stony. The Agency soils were derived from sedimentary and basaltic rocks and are very stony. They have a light brownish-gray sandy loam surface layer and a clay loam subsoil, and they are underlain by bedrock at a depth of 18 to 40 inches.

Also in this association are areas of Rock land and of Bakeoven, Salisbury, Deschutes, Redmond, and Day soils. Rock land consists of rock outcrops that occur with Gem, Lookout, and Agency soils and with Bakeoven soils. The Salisbury soils lie on alluvial fans, commonly below the Gem soils, and were derived from basaltic alluvium. In these soils the surface layer is grayish-brown loam, the subsoil is clay, and a hardpan is 16 to 24 inches below the surface. Most of the acreage in Salisbury soils is very stony. The Deschutes soils are pumiceous, light brownish-gray sandy loams and loamy sands. Redmond soils are grayish brown and are pumiceous in the surface layer, but they have a loam or clay loam subsoil. The Day soil is reddish-brown clay.

A few small areas of this association are dryfarmed, mainly to rye, but nearly all the acreage is in range or dryland pasture that is grazed along with nearby irrigated fields. The vegetation consists chiefly of bunchgrasses, sagebrush, rabbitbrush, juniper, and bitterbrush. Stands of bunchgrasses are denser on north-facing slopes than on south-facing ones.

**8. Searles-Slayton association: Soils from tuff and rhyolite rock on uplands**

This association occurs on upland areas that are just above areas of Courtrock, Ochoco, and Prineville soils on alluvial fans and terraces. Most of it is hilly and is underlain by tuff bedrock. The association occupies about 4 percent of the Prineville Area.

The Searles soils make up about 35 percent of this association, and the Slayton soils cover about 30 percent. Gem soils make up about 10 percent. Rock land occurs with all of these soils and accounts for about 10 percent of the total acreage. Most of the rest is Lamonta and Polly soils.

The stony Searles soils have a surface layer of light brownish-gray to grayish-brown sandy loam to clay loam and a subsoil of clay loam. Tuff bedrock generally occurs at a depth of 16 to 40 inches. The Slayton soils have a light brownish-gray sandy loam surface layer and a sandy loam subsoil. Under these layers is tuff bedrock at a depth of 8 to 20 inches. In the stony Gem soils the surface layer is grayish-brown loam or clay loam, and the subsoil is clay loam. Basalt bedrock is 1 to 3 feet below the surface. The Lamonta soils are on alluvial fans and formed in alluvium derived from rhyolite, tuff, and basalt. They have a light brownish-gray loam surface layer, a clay subsoil, and an indurated gravelly hardpan at a depth of 18 to 30 inches. The Polly soils have a dark-gray or grayish-brown surface layer and a clay loam subsoil.



Most of this association is used for pasture and range. A few small areas were dryfarmed and then were abandoned. Later, some of these areas were seeded to crested wheatgrass, and others were invaded by cheatgrass and rabbitbrush. Much of this association is overgrazed, and juniper is increasing in the stand.

**9. Ayres-Ochoco-Bakeoven-Deschutes association: Soils with hardpan and soils from pumiceous material on the basaltic plateau**

This association occupies about 7 percent of the survey area. Most of it is on slopes of 0 to 6 percent and is underlain by basalt. The drainage pattern is not prominent.

About 60 percent of the association consists of Ayres and Ochoco soils. About 15 percent is Bakeoven soils, and 15 percent is Deschutes soils. The remaining acreage consists chiefly of Redmond and Agency soils.

The Ayres soils have a light brownish-gray surface layer, a gravelly or cobbly clay loam subsoil and, at a depth of 12 to 20 inches, an indurated hardpan. In the Ochoco soils a hardpan occurs at a depth of 20 to 36 inches, but in other respects these soils are similar to the Ayres soils. Bakeoven soils are very stony and are only 6 to 12 inches deep to basalt bedrock. Deschutes soils are pumiceous and have a surface layer of light brownish-gray sandy loam or loamy sand. The Redmond soils are grayish brown and are pumiceous, but their subsoil is loam or clay loam. The Agency soils are light brownish gray and very stony. They have a sandy loam surface layer and a clay loam subsoil over bedrock at a depth of 18 to 40 inches.

Nearly all of this association is used for range, and most of it has been heavily grazed. About one-third of the association is suitable for irrigation and, if water were available, could be irrigated. Under good management, range and pasture can safely be used in spring or in fall, or both, depending on the amount of important forage grasses that is grazed.

The Prineville Airport is on this association.

# *Use and Management of Soils*

This section discusses principles of soil management, capability groups of soils, estimated yields of principal crops, and the use of soils in engineering.

## Principles of Soil Management

Some of the principles and practices important in the use and management of soils in the Prineville Area are described in the following pages.

### *Crop rotations*

A good crop rotation is essential in maintaining yields, improving fertility, and conserving soil and water. Higher yields can be obtained if potatoes are alternated with wheat or barley than if any of these crops is grown continuously. Growing potatoes or other row crops year after year tends to lower the content of plant nutrients and organic matter, causes gradual deterioration in soil structure, increases the risk of erosion, promotes disease and

insect pests, and slows the rate of water intake. These effects can best be offset by using grasses and legumes in rotation with row crops and small grain.

Grasses and legumes are close-growing crops that have beneficial effects of the soil (*10*). Their abundant and extensive root system supplies organic matter, improves structure, decreases erosion, and raises the content of nitrogen and other nutrients. As a result, the soil produces higher yields of row crops and small grain if they are grown in rotation.

Crop rotations are not rigid in this Area, but generally a row crop is grown for 1 or 2 years, then a small grain for 1 year, and finally a legume for 4 to 6 years. The most common row crop is potatoes, and the principal small grains are wheat and barley, though some oats are grown. A small grain is frequently used as a companion, or nurse, crop for a new seeding of alfalfa or clover. By far the most important legume is alfalfa. If seeded pasture is included in the rotation, using alfalfa or clover mixed with alta fescue, smooth brome, or orchardgrass lessens the chance of bloat, provides forage of better balance and finer fiber, and results in a more extensive root system for improving soil structure. Such a rotation maintains productivity, and it also provides the flexibility needed to meet changing economic conditions in an area where potatoes are the most important row crop.

### *Organic matter*

Maintaining or increasing the organic-matter content is probably the most important problem of soil management throughout the Area. All the soils have a low content of organic matter. It is less than 1.5 percent in many virgin soils and commonly ranges from 2.0 to 3.0 percent in the most favorable soils.

Organic matter is chiefly responsible for the larger and more stable forms of soil aggregation, and it improves permeability, aeration, and structure. It contains an appreciable amount of nitrogen—an element needed in large quantity by plants—as well as phosphorus, sulfur, and other essential plant nutrients. By serving as a source of energy for the micro-organisms that live in the soil, organic matter aids these organisms in making many of the essential nutrients available to plants.

Organic matter can be added to the soil by plowing under crop residues or green-manure crops, by applying barnyard manure, or by growing grasses and legumes in the crop rotation. Turning under crop residues is a desirable practice used by most farmers, though alone it does not provide enough material to maintain the organic-matter content at a satisfactory level. All plant residues should be returned to the soil except those harboring insect pests and those from greasewood, a shrub that accumulates salts in its tissues and is best removed from the farming area rather than plowed under or burned.

Not much barnyard manure is available on farms where potatoes or small grain is the principal crop and few or no livestock are kept. On these farms a suitable way to supply organic matter and plant nutrients to the soil is by turning under green-manure crops or by using grasses and legumes in the rotation. If alfalfa, clover, and other legumes are properly inoculated, they fix nitrogen from the air and may add several hundred pounds of nitrogen per acre when plowed under.

Grasses have an abundance of fine, fibrous roots that generally are well distributed throughout the upper part of the soil. As the roots slowly decay, they add organic matter to the soil and reduce the likelihood of erosion.

### *Tillage*

Proper tillage is essential in the management of crops and soils. The main purposes of tillage are to prepare a good seedbed, to destroy weeds that compete with crops for water and nutrients, to improve the physical condition of the soil, and to control soil erosion. By providing a cloddy surface and retaining crop residues as a surface mulch, tillage on the contour or across the slope helps to control soil losses.

The soils in the Prineville Area are sandy and contain little organic matter. In the western part of the Area, where the soils generally have a low degree of aggregation, tillage loosens the surface layer, at least temporarily. If the content of organic matter were higher in these soils, the soil-improving effects of tillage would be greater and longer lasting.

Some farmers, especially potato growers, use subsurface chiseling to loosen the lower layers in the soil.

### *Leveling*

In preparing soils for irrigation, leveling is needed almost everywhere in the survey area. If soils are properly leveled, water moves quickly and evenly over a field and wets the rooting zone to a uniform depth. After the first job of leveling, some floating is needed at least once a year so that high spots are eliminated, low spots are filled, and crops are irrigated uniformly without wasting water at the lower end of the field. Ordinarily, several years of floating are required before a field is properly leveled and the distribution of water is fast and efficient.

### *Salts and alkali*

Of the soils on bottom land and low terraces, about one-fourth the acreage is sodic, or affected by alkali. Sodic soils have a high percentage of exchangeable sodium that is held by the soil particles. Exchangeable sodium affects soils by tending to (1) make them strongly alkaline, with high pH values, (2) replace the calcium, potassium, and magnesium that are exchangeable and are important as plant nutrients, (3) reduce the amount of water available to plants, and (4) disperse or puddle the soil so that water enters and moves through it at a reduced rate. Plants may be severely injured or even killed by sodic soils.

Also injurious to plants are excessive amounts of salts. Soils that contain soluble salts are called saline soils. In the Prineville Area, they are less common than alkali-affected soils and are a much less serious problem.

Plants differ in their tolerance of salts and exchangeable sodium. Some kinds of plants are much more tolerant than others, and some salts appear to be more harmful than others. Sprouting seeds and young seedlings are more easily injured than well-established plants. Alfalfa and other deep-rooted crops may be harmed by salts or alkali in the lower subsoil that do not affect shallow-rooted crops. At the soil surface, however, the same amount of salts or alkali might be injurious to all crops.

The effects of a given amount of salts and exchangeable sodium on sandy soils are more pronounced than on clayey soils, but their effects in clayey soils are more serious. Although a high content of moisture may decrease salinity, this is not enough to restore sodic soils to produc-

tivity. The undesirable effects of excess sodium generally are not evident, however, as long as considerable amounts of soluble salts are present.

On slightly sodic soils there is little injury to cultivated crops. On moderately sodic soils, all crops except the most tolerant ones are injured and their yields are reduced. Strongly sodic soils are not suitable for commercial crops, and they are either covered by saltgrass, greasewood, and other tolerant plants or are entirely bare of vegetation.

In this Area most saline soils also are sodic. Because the water used for irrigation contains only a small amount of soluble salts, reclamation can be directed mainly toward reducing the content of exchangeable sodium. In most places the salts are leached out if the excess sodium is removed.

In restoring sodic soils to productivity, two needs must be met. The first need is for adequate underdrainage and an improvement in soil structure so that water can move freely through the soil. The second is for applications of a chemical amendment containing exchangeable calcium to replace the sodium, for most soils in the Area do not have an adequate content of calcium. After the sodium is replaced, it can then be leached away.

Gypsum is an amendment commonly used as a source of calcium. Lime also contains calcium, but it is slowly soluble and its corrective action is slow. Sulfur aids in reclaiming soils that contain lime. If desired, lime and sulfur can be used together as a replacement for gypsum.

In the sodic soils of this Area, natural underdrainage is not adequate for much movement of water through the soil. If artificial drainage is provided, the nature of the soil determines the amount of water that can move though it.

The Stearns soils have a slowly permeable subsoil and a hardpan that prevent much reduction in the alkali content, even under the most favorable conditions. The Crooked soils, however, are more permeable above the hardpan and can be improved enough for shallow-rooted crops to be grown. Because the Forester soils are rapidly or very rapidly permeable throughout, they can be readily reclaimed if drainage is improved and seepage is eliminated. Reclaiming the Forester soils requires adequate drainage that keeps the water table at least 4 feet, but preferably 6 feet, below the surface.

Little use has been made of draining and leaching as means of improving sodic soils in the Prineville Area, but two drainage ditches have been constructed. These ditches are effective in lowering the water table in nearby soils, and both have helped in the reclamation of adjacent sodic fields.

Although most sodic soils in this Area can be reclaimed, the cost of reclamation may be too high at the present time. Sodic spots scattered in a productive field can be partly or completely reclaimed, and thereby improved for increased production of farm crops, by (1) providing for the prompt removal of surface and subsurface water, (2) plowing under moderate or large amounts of barnyard manure, and (3) using gypsum or sulfur and irrigating frequently until a crop is established.

### Drainage

Artificial drainage is needed in most irrigated areas. Waterlogging is common in soils where internal drainage is too slow for excess irrigation water to drain away. Seepage causes wet spots and, in many places, a perched water table. A drainage system is especially needed in areas that are irrigated by gravity flow. In the Prineville Area, improved drainage is of primary concern on the terraces and bottom land in and around the city of Prineville.

Nearly all the irrigated acreage east of the Crooked River is gently sloping and occurs on high terraces and alluvial fans. Because many of the soils are underlain by a hardpan or a slowly permeable substratum, water tends to build up in the subsurface layers. At one time the draining of soils in these areas was mistakenly considered a matter of concern only to the individual farmer, who disposed of waste water from his farm by constructing small ditches and drains that carried the water to his neighbor's farm. Removing water in this way tends to aggravate the drainage problem, for excess water flowing downhill is likely to drown out the lower areas and to cause an accumulation of salts and sodium in the soils.

It is expected that additional water will be made available and more land will be brought under irrigation around the city of Prineville. If this expansion occurs, drainage is likely to worsen on the low terraces and the bottom land, unless it is corrected by installing a central system of drains or by forming a drainage district.

Many swales on the high terraces north of Prineville are much too wet for irrigation because of seepage or the lateral movement of water. Some of the swales have been dammed and are used to store water for irrigating nearby fields through sprinklers. An adequate system of drains is needed in this area.

In the Powell Butte community, water draining from the pumicy upland plateau is discharged into Huston Lake. Because the lake is permanent, it provides hunting, fishing, and other forms of recreation. In the adjacent soils, however, it also raises the ground water, which reduces yields of alfalfa and, in places, brings salts to the surface.

### Fertilizer

The soils of this Area generally contain phosphorus and potassium in amounts adequate for crops. None of the soils contain much sulfur, an element needed for high yields. Also needed, but in smaller amounts, are calcium, iron, and magnesium. The supply of these elements generally is adequate in most soils, and many of the soils have an abundance of calcium and magnesium.

Soils throughout the Area generally are too low in nitrogen for adequate growth of plants; added nitrogen increases yields of nonlegumes. Potatoes respond to additions of phosphorus, and sulfur and phosphorus generally increase production of alfalfa and other legumes.

Among the minor elements needed for plant growth are copper, zinc, molybdenum, boron, chlorine, and manganese. None of the soils in the Prineville Area is naturally deficient in these elements, though shortages may occur in shallow, coarser textured soils that are heavily cropped.

Generally, potatoes respond most if fertilized with nitrogen, phosphorus, potassium, and sulfur. On soils where potatoes in the rotation are followed by small grain, a smaller amount of nitrogen is applied, but little or no phosphorus. Only phosphorus and sulfur are used on alfalfa, and nitrogen and phosphorus are used on pasture. On some strongly calcareous soils, alfalfa yields may be increased by adding phosphorus in split applications.

Except for potatoes, crops generally do not respond to a complete fertilizer, but one is likely to be needed on shallow, coarse-textured soils after only a short period of intensive cropping. Field trials indicate that sulfur is needed throughout the Area and that applications of sulfur increase crop yields significantly. Both gypsum and sulfur are used in reclaiming alkali-affected soils.

## Irrigation

Most crops grown in the Prineville Area are irrigated. Water is applied by two general methods, surface irrigation and sprinkler irrigation (*11*).

### SURFACE IRRIGATION

Crops in this Area are most commonly irrigated by surface methods. These are flood irrigation, furrow irrigation, and corrugation irrigation. In a field that is well prepared for flood irrigation, the water flows in a continuous sheet and is evenly distributed over the entire field. Most fields, however, are not prepared for efficient flooding and, if they are irrigated by this method, water is applied more heavily in some parts than in others. For this reason, there are several systems of flood irrigation in which the water is distributed on the field between borders, in basins, between contour borders, from contour ditches, by wild flooding, or from border ditches.

*Border irrigation.*—In border irrigation, water flows in a uniform sheet down a narrow strip between low ridges, or borders. The water enters the soil as it advances. Irrigating efficiently by this method requires strips that are level between the borders and have a uniform grade. Border irrigation is commonly used in the Area for irrigating alfalfa, clover, pasture, and other close-growing crops. A large volume of water is needed, but the labor requirement is low, water is efficiently used, and irrigation is uniform.

*Basin irrigation.*—In this method, a diked area is quickly filled with water to a desired depth. The water is then absorbed into the soil. Basin irrigation is most suitable for irrigating level soils and for reclaiming the Crooked, Forester, and other sandy soils affected by alkali.

*Contour borders.*—In this method, the borders are parallel and are laid out across the slope; between them are strips that resemble basins. Each strip is higher than the one just below it and is lower than the next strip above it. Applying water between contour borders is a suitable method of irrigating many sloping soils, but it cannot be successfully used in areas where the soils are pumicy.

*Contour ditches.*—In this method, the applied water flows down the slope between ditches laid out along the contour. The method is suitable for irrigating sloping soils east of the Crooked River. In the western part of the Area, where the soils are pumicy, the ditches do not hold well, because the pumice tends to float away.

*Wild flooding.*—This method consists of diverting a stream of water from its course and allowing it to spread over a field. Water is not applied uniformly, for low spots receive too much water and high spots too little. Consequently, crops in low areas may be drowned, and the salt content in high areas is increased.

*Border ditches.*—In this method, water is carried in ditches that run down the field in the direction of the slope. The ditches can be several hundred feet apart. Between them are strips that are irrigated by diverting water from the ditches. Unless drop boxes, headgates, and other control structures are installed, the ditches erode and more labor is required to spread the water over the field.

*Furrow irrigation.*—This is the most common method of applying water to row crops in the Area and is used for irrigating potatoes. The water is applied in furrows that are between the plant rows. On soils where the furrows run downslope, severe erosion is likely unless the size of the irrigating stream is well controlled.

*Contour furrows.*—This method is a slight modification of furrow irrigation. The furrows are laid out across the slope on a selected grade that is less than the general grade of the field. Reducing the grade of the furrows reduces the rate of flow and thereby lessens the risk of erosion.

*Corrugation irrigation.*—This method is suitable for irrigating close-growing crops on soils that are sloping to rolling and generally are too steep for either border or furrow irrigation. The water is taken from a head ditch and is applied downslope in small furrows. This is a good method of irrigating small grain in the Prineville Area.

### SPRINKLER IRRIGATION

In this method, water is brought to a field in pipe under pressure and is sprinkled on the soil through nozzles. If a system of sprinklers is well designed and properly installed, water can be safely applied to soils that are too steep for other methods. The water is uniformly distributed and efficiently used. The cost of labor is reduced, the amount of water required is small, and the need for ditching and leveling is eliminated. Among the limitations on sprinkler irrigation are the high initial cost, the uneven distribution of water in windy periods, the large loss of water by evaporation, and the need for a supply of clean water.

## Erosion

Erosion losses are caused principally by wind in the survey area, particularly on the coarser textured soils. Because most cultivated soils are nearly level, water erosion generally is a minor problem, though gullying occurs in some irrigation systems and in some waterways that carry flash runoff from sudden and heavy storms. Cultivated fields in fallow or on slopes of as much as 6 to 15 percent are subject to washing.

On the upland plateau the Deschutes and the Ayres soils, which developed from light-weight pumice, are subject to moderate wind erosion early in spring. During this period a cover of plants or crop residues is needed on these soils.

Many of the sandy soils in the Area were unsuccessfully dryfarmed years ago. After cultivation had been abandoned, the soils were moderately or severely eroded by wind and, in a few places, were marked by sandy blowouts. The erosion occurred mainly in the western part of the Area, where the coarser textured soils have a naturally low content of organic matter. On soils under irrigation, the hazard of wind erosion is much less severe.

Practices that help to control erosion on all cultivated soils are stubble mulching, cover cropping, and plowing under crop residues (*7*). Wind erosion can be greatly reduced on irrigated soils by wetting the soils just before and just after cultivation. Planting windbreaks and stripcropping at right angles to the prevailing wind are

other measures for controlling wind erosion. Leveling, carefully using irrigation water, constructing grassed waterways, and installing drop boxes, headgates, and other irrigation structures are effective in the control of water erosion.

## Capability Groups of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risks of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through III. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, which are groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive reshaping that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in the Prineville Area, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use. No soils in the Prineville Area are in this class.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe–1.—Moderately deep, well-drained, gently sloping soils that have a moderately coarse textured subsoil.
  - Capability unit IIe–2.—Deep, well-drained, gently sloping soils that have a moderately coarse textured or medium-textured subsoil.
  - Capability unit IIe–3.—Moderately deep, well-drained, gently sloping soils that have a medium-textured or moderately fine textured subsoil.
  - Capability unit IIe–4.—Shallow to deep, well-drained, nearly level or gently sloping soils that have a clayey subsoil.
  - Capability unit IIe–5.—Shallow, well-drained, gently sloping soils that have a hardpan.
  - Capability unit IIe–6.—Nearly level, moderately well drained or well drained soils of the flood plains that are occasionally flooded and subject to channeling and washing in spring.
- Subclass IIs. Soils that have moderate limitations of moisture capacity or tilth.
  - Capability unit IIs–1.—Nearly level, well-drained, moderately deep soils that have a moderately coarse textured subsoil.
  - Capability unit IIs–2.—Nearly level, well-drained, deep soils that have a hardpan or a gravelly substratum.
  - Capability unit IIs–3.—Nearly level, well-drained soils that have a medium-textured or moderately fine textured subsoil or substratum.
  - Capability unit IIs–4.—Nearly level, shallow, well-drained soils that have a hardpan.
  - Capability unit IIs–5.—Nearly level, deep, moderately coarse textured or medium-textured soils.
- Subclass IIc. Soils that have moderate limitations because of climate.
  - Capability unit IIc–1.—Deep, well-drained, nearly level soils on flood plains.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

- Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
  - Capability unit IIIe–1.—Moderately deep, well-drained, sloping soils that have a moderately coarse textured subsoil.
  - Capability unit IIIe–2.—Deep, well-drained, sloping soils that have a moderately coarse textured or medium-textured subsoil.
  - Capability unit IIIe–3.—Shallow to deep, well-drained, sloping soils that have a medium-textured or moderately fine textured subsoil.
  - Capability unit IIIe–4.—Shallow or moderately deep, well-drained, sloping soils that have a hardpan.
- Subclass IIIw. Soils that have severe limitations because of excess water.

Capability unit IIIw-1.—Well-drained to poorly drained soils that are on flood plains or in low areas on terraces and have moderate or moderately slow permeability.

Capability unit IIIw-2.—Imperfectly drained, pumiceous, mainly coarse textured or moderately coarse textured soils that contain alkali.

Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.

Capability unit IIIs-1.—Nearly level or gently sloping, well-drained to excessively drained soils that have very sandy upper layers.

Capability unit IIIs-2.—Nearly level or gently sloping, moderately coarse textured and medium-textured soils that are well drained or somewhat excessively drained.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.

Capability unit IVe-1.—Sloping or moderately steep, well-drained, shallow to deep soils that have moderately slow to rapid permeability.

Subclass IVw. Soils that have very severe limitations for cultivation because of excess water.

Capability unit IVw-1.—Imperfectly drained soils that are in basins and have a clayey subsoil.

Capability unit IVw-2.—Poorly drained, clayey soils on flood plains.

Capability unit IVw-3.—Imperfectly drained, medium-textured soils that are affected by alkali and have a hardpan at a depth of 12 to 30 inches.

Subclass IVs. Soils that have very severe limitations because of coarse texture.

Capability unit IVs-1.—Moderately deep to very deep, sloping to moderately steep loamy sands that have very rapid permeability.

Capability unit IVs-2.—Nearly level or gently sloping, well-drained or somewhat excessively drained, shallow to deep, stony soils.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Capability unit Vw-1.—Frequently flooded, very poorly drained soils on bottom land.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIe-1.—Nearly level to steep, stony soils.

Capability unit VIe-2.—Sloping to steep, stony soils that have a loamy surface layer and a clayey subsoil.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to range, woodland, or wildlife.

Subclass VIIs. Soils very severely limited by moisture capacity, stones, or other soil features.

Capability unit VIIs-1.—Nearly level to steep, shallow or moderately deep, very stony soils.

Capability unit VIIs-2.—Nearly level to moderately steep, very stony, generally shallow soils.

Capability unit VIIs-3.—Steep, stony, severely eroded soils and very steep, very stony soils.

Capability unit VIIs-4.—Nearly level to steep, shallow to deep, very stony soils.

Class VIII. Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, mining, or esthetic purposes.

Subclass VIIIs. Rock or soil material that has little potential for production of vegetation.

Capability unit VIIIs-1.—Land types and soils that, in most places, are too stony or too rocky for agricultural use.

### *Management by capability units*

In the following subsection, each of the capability units in the Prineville Area is described and the soils in it are listed. Suggestions are given on how to use and manage the soils in each unit.

#### CAPABILITY UNIT IIe-1

This unit consists of well-drained, moderately coarse textured soils that are 18 to 42 inches deep. Slopes range from 2 to 6 percent. These soils have rapid or moderately rapid permeability, low to moderate moisture-holding capacity, and low fertility. Erosion is a moderate hazard. The soils are—

Deschutes sandy loam, 2 to 6 percent slopes.
Deschutes sandy loam (2 to 6 percent slopes) (in DvB).
Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes.
Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes.
Prineville sandy loam, 2 to 6 percent slopes.
Prineville gravelly sandy loam, 2 to 6 percent slopes.

These soils are well suited to irrigation, and all the common crops do well on them, but irrigation on the gentle slopes is slightly difficult. Suitable crop rotations for irrigated areas are (a) 1 or 2 years of potatoes, 1 year of small grain, and 5 years of alfalfa; (b) 1 or 2 years of small grain followed by 5 years of alfalfa or alfalfa-grass; and (c) 1 or 2 years of small grain and 2 years of Ladino clover for seed. Apply fertilizer according to needs indicated by soil tests.

For irrigating potatoes, contour furrows are most suitable because they help to control erosion and to conserve water. Alfalfa or other plants for hay and pasture, clover for seed, and small grain can be irrigated by use of corrugations, sprinklers, or controlled flooding from contour ditches. Border irrigation can be used for close-growing crops where slopes do not exceed 4 percent.

In dryland areas the soils of this unit are suitable only as range. Properly grazing the range only in spring and fall helps native plants maintain their vigor. Grasses suitable for reseeding are crested wheatgrass and Siberian wheatgrass (*9*).

#### CAPABILITY UNIT IIe-2

This unit consists of well-drained soils that are 42 to more than 60 inches deep and have a moderately coarse textured surface layer and a moderately coarse textured or medium-textured subsoil. Slopes range from 2 to 6 percent. These soils are moderately to rapidly permeable and have moderate moisture-holding capacity and fertility. The erosion hazard is moderate. The soils are—

Courtrock sandy loam, 2 to 6 percent slopes.
Courtrock gravelly sandy loam, 2 to 6 percent slopes.
Metolius sandy loam, 2 to 6 percent slopes.
Prineville sandy loam, thick surface, 2 to 6 percent slopes.

The Courtrock and Metolius soils have a substratum of porous sand or gravel; the Prineville soil has a hardpan underlying the subsoil.

These soils are well suited to irrigation, though their gentle slopes are slightly difficult to irrigate. In most places they are well suited to all crops grown in the survey area. The Prineville soil is particularly desirable for potatoes, but along the Dry River where frost is a hazard the Metolius soil is not suited to potatoes.

In irrigated areas the content of organic matter can be increased by using a suitable crop rotation. A satisfactory rotation is (a) 1 or 2 years of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa; or (b) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa or alfalfa-grass. Fertilizer should be applied according to needs indicated by soil tests.

Deep cuts can be made in these soils where leveling is needed to improve the management of irrigation water. Irrigating potatoes from contour furrows helps to control erosion and to conserve water. Small grain, as well as alfalfa or other plants grown for hay and pasture, can be irrigated by use of corrugations, sprinklers, or controlled flooding from contour ditches. On slopes of not more than 4 percent, these crops can also be irrigated by the border method.

In some areas the soils of this capability unit are dryfarmed to small grain, principally rye that is grown for livestock feed. If stubble-mulch tillage is used during the fallow period, a farming system of small grain alternated with summer fallow is effective in keeping soil losses to the minimum. Areas of native range in poor condition can be seeded to crested wheatgrass or Siberian wheatgrass. These dryland areas are highly suitable for irrigation, however, and could be used more intensively if water were available.

#### CAPABILITY UNIT IIe-3

In this capability unit are gently sloping, moderately deep, well-drained soils that have a medium-textured or moderately fine textured subsoil. Their surface layer is moderately coarse textured or medium textured. Slopes range from 2 to 6 percent. These soils have moderate or moderately slow permeability and moderate fertility and moisture-holding capacity. They are moderately susceptible to erosion. The soils are—

Deschutes sandy loam, moderately deep over hardpan, 2 to6 percent slopes.
Ochoco loam, 2 to 6 percent slopes.
Ochoco gravelly loam, 2 to 6 percent slopes.
Ochoco sandy loam, 2 to 6 percent slopes.
Ochoco sandy loam, 2 to 6 percent slopes (in AoB).
Ochoco gravelly sandy loam, 2 to 6 percent slopes.
Redmond sandy loam, 2 to 6 percent slopes.

These soils are well suited to irrigation, and to all crops grown locally, but irrigating the gentle slopes is slightly difficult. Crop rotations suitable for irrigated areas are (a) 1 or 2 years of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa; (b) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa or alfalfa-grass; and (c) 1 or 2 years of small grain followed by 4 to 6 years of Ladino clover and grass. Fertilize in amounts indicated by soil tests. Wind erosion can be controlled in irrigated fields by using suitable rotations and by keeping the soils moist during the windy period.

Because the soils of this unit are only moderately deep, care is needed in leveling to avoid cutting them so deeply that large areas are made shallow to the underlying hardpan or bedrock. For irrigating potatoes, contour furrows are most suitable because they help to control erosion and to conserve water. Small grain, alfalfa, and other plants for hay and pasture can be irrigated by use of corrugations, sprinklers, or controlled flooding from contour ditches or, where slopes do not exceed 4 percent, by use of borders.

In dryfarming areas a cropping system of small grain and summer fallow, together with stubble mulching during the fallow period, helps to control wind and water erosion. Suitable grasses for seeding range and other dryland areas are crested wheatgrass and Siberian wheatgrass. These areas could be used more intensively if irrigation water were available.

#### CAPABILITY UNIT IIe-4

This unit consists of nearly level or gently sloping, shallow to deep, well-drained soils that have a medium-textured or moderately coarse textured surface layer and a clay or clay loam subsoil. These soils have slow or moderately slow permeability. Their moisture-holding capacity and fertility range from low to high. Erosion is a moderate hazard. The soils are—

Lamonta loam, 0 to 6 percent slopes.
Lookout loam, 0 to 2 percent slopes.
Lookout loam, 2 to 6 percent slopes.
Polly loam, 0 to 6 percent slopes.
Polly gravelly loam, 0 to 6 percent slopes.
Polly sandy loam, 2 to 6 percent slopes.
Polly sandy loam, thick surface, 2 to 6 percent slopes.
Salisbury loam, 0 to 6 percent slopes.

The suitability of these soils for irrigation ranges from very good to fair, though much of the acreage occurs above existing canals. Because the soils have a fine textured or moderately fine textured subsoil, they are poorly suited to potatoes. They are well or moderately well suited to all other irrigated crops and to all dryland crops grown in the Area.

A suitable crop rotation for irrigated areas is 1 or 2 years of small grain followed by 4 to 6 years of alfalfa, alfalfa and grass, or Ladino clover and grass. Fertilizer should be applied in amounts indicated by soil tests. In fields of irrigated grasses and legumes for hay or pasture, heavy applications of nitrogen stimulate the grasses and tend to decrease the growth of legumes, whereas additions of phosphate and sulfur increase the growth of legumes.

These soils have a slow rate of water intake, particularly if leveling exposes the clayey subsoil. Suitable methods of irrigating alfalfa, other plants for hay and

pasture, and small grain are corrugations, sprinklers, and controlled flooding from contour ditches.

In dryland fields where small grain is alternated with summer fallow, stubble mulching reduces erosion and conserves moisture. Soil losses are less if grain stubble is left standing through winter following harvest than if it is disturbed by plowing, disking, or sweeping. In fields where stubble is disturbed in fall, the soil should be left rough and cloddy through winter.

Suitable grasses for dryland areas of Lamonta and Lookout soils are crested wheatgrass, Siberian wheatgrass, and Whitmar beardless wheatgrass. A suitable dryland mixture for Polly and Salisbury soils is pubescent wheatgrass and alfalfa.

#### CAPABILITY UNIT IIe-5

This unit consists of shallow, well-drained soils that have a moderately coarse textured surface layer and a gravelly or cobbly loam or clay loam subsoil over a very hard, gravelly hardpan. Slopes range from 2 to 6 percent. These soils have moderately slow permeability in the subsoil. Their moisture-holding capacity and fertility are low. Under irrigation, the soils are moderately susceptible to erosion. They are—

Ayres sandy loam, 2 to 6 percent slopes.
Ayres sandy loam, 2 to 6 percent slopes (in AoB).
Ayres gravelly sandy loam, 2 to 6 percent slopes.

These soils are well suited to irrigation, but about half the acreage occurs above present canals. A small part of the dryland acreage is cultivated to rye for grain. The soils are well suited to grasses and legumes that are shallow rooted. A suitable rotation for irrigated areas is 1 or 2 years of small grain followed by 4 to 6 years of Ladino clover and grasses. Less suitable but satisfactory is a rotation consisting of potatoes for 1 or 2 years, small grain for 1 year, and alfalfa-grass for 4 to 6 years. Apply fertilizer according to needs indicated by soil tests.

Leveling these soils is difficult, for they are shallow and sloping. Water can be effectively applied to potatoes from contour furrows and to alfalfa, other plants for hay and pasture, and small grain by use of corrugations, sprinklers, or controlled flooding from contour ditches.

Although precipitation is low, dryland areas used for small grain generally receive enough moisture to fill the shallow root zone. Annual cropping is suitable for these areas and results in less erosion than a system of alternate grain and summer fallow. Grasses suitable for dryland seeding are crested wheatgrass and Siberian wheatgrass.

#### CAPABILITY UNIT IIe-6

The soils of this unit are nearly level and moderately well drained or well drained. These soils occur on alluvial flood plains and are occasionally flooded and subject to channeling and washing in spring. They are medium textured or moderately coarse textured from the surface to the gravel and sand substratum. Their permeability is moderate or moderately rapid, and their moisture-holding capacity and fertility range from low to very high, depending on thickness and texture of the soil. There is little or no erosion hazard. The soils are—

Powder fine sandy loam, coarse variant.
Powder fine sandy loam, over gravel, coarse variant.
Powder gravelly loam.
Powder silt loam.
Powder silt loam, over gravel.

These soils are well suited to irrigation, though they are easily overirrigated. They are poorly suited to potatoes but are well or moderately well suited to all the other crops grown locally under irrigation. Care is needed in irrigating alfalfa and other deep-rooted crops, for too much water lowers yields. A suitable rotation is 1 or 2 years of small grain followed by several years of alsike clover and grasses. Alfalfa or Ladino clover can be substituted for alsike clover in the rotation.

Where leveling is needed, deep cuts can safely be made in all the soils of this unit except those that are shallow to sand or gravel. Suitable kinds of irrigation are the border and the sprinkler methods. In addition, corrugations are suitable on slopes that exceed 1 percent.

#### CAPABILITY UNIT IIs-1

In this unit are nearly level, moderately deep, well-drained soils that have a moderately coarse textured surface layer and subsoil. These soils are rapid or moderately rapid in permeability and are low to moderate in moisture-holding capacity and fertility. Erosion is only a slight hazard. The soils are—

Deschutes sandy loam, 0 to 2 percent slopes.
Deschutes sandy loam (0 to 2 percent slopes) (in DvB).
Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes.
Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes.
Prineville sandy loam, 0 to 2 percent slopes.

These soils are well suited to irrigation, and all the common crops do well on them. Suitable rotations for irrigated areas are (a) 1 or 2 years of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa or Ladino clover grown alone or in mixture with grass; and (b) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa or Ladino clover and grass. Fertilizer should be applied according to needs indicated by soil tests.

Furrows are suitable for irrigating potatoes and, if slopes are greater than 1 percent, the furrows should be on the contour so that erosion is controlled and water is conserved. For irrigating alfalfa, other hay plants, pasture, and small grain, suitable methods are borders and sprinklers. On slopes exceeding 1 percent, corrugations also are used.

In dryland areas the soils of this unit are suited only to plants used for grazing. Crested wheatgrass and Siberian wheatgrass are satisfactory for seeding.

#### CAPABILITY UNIT IIs-2

This unit consists of nearly level, well-drained soils that occupy alluvial fans and are 42 to more than 60 inches deep. These soils have a moderately coarse textured surface layer. Their permeability is moderate or moderately rapid, and their moisture-holding capacity and fertility are moderate. The soils are only slightly susceptible to erosion. They are—

Courtrock gravelly sandy loam, 0 to 2 percent slopes.
Prineville sandy loam, thick surface, 0 to 2 percent slopes.

The Courtrock soil has a moderately coarse textured or medium-textured subsoil and a lower substratum of porous sand or gravel. The Prineville soil has a coarse textured or moderately coarse textured subsoil but is underlain by a hardpan over softly consolidated, tuffaceous sandstone.

These are good soils for irrigation, and they are well suited to all crops grown in the Area. Because of its

gravelly surface layer, the Courtrock soil is less desirable for potatoes than the Prineville soil. Suitable rotations are (a) 1 or 2 years of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa or Ladino clover planted alone or in mixture with grass; and (b) 1 or 2 years of small grain followed by 4 to 6 years of a legume or a grass-legume mixture. Fertilize in amounts indicated by soil tests.

The soils of this unit are deep enough for leveling cuts to be made as needed to improve the spread of irrigation water. For irrigating potatoes, furrows should be on the contour if slopes are greater than 1 percent. Small grain, as well as alfalfa and other plants used for hay or pasture, can be irrigated by use of borders or sprinklers or, on slopes of more than 1 percent, by use of corrugations.

In most places wind erosion can be controlled if the soil surface is protected with crop residues or sod and if bare areas are kept moist during the windy season.

In dryfarming areas where small grain is alternated with summer fallow, stubble-mulch tillage keeps erosion to the minimum. Grasses suitable for seeding dryland soils are crested wheatgrass and Siberian wheatgrass. All of these areas could be used more intensively if irrigation water were available.

#### CAPABILITY UNIT IIs-3

This unit consists of nearly level, well-drained soils that have a moderately coarse textured or medium-textured surface layer and a medium-textured or moderately fine textured subsoil or substratum. These soils generally are moderately deep and have moderate or moderately slow permeability. They are moderate in fertility and moisture-holding capacity. Erosion is only a slight hazard. The soils are—

- Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes.
- Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes.
- Ochoco loam, 0 to 2 percent slopes.
- Ochoco gravelly sandy loam, 0 to 2 percent slopes.
- Ochoco gravelly sandy loam, 0 to 2 percent slopes (in ArA).
- Ochoco sandy loam, 0 to 2 percent slopes.
- Ochoco sandy loam, 0 to 2 percent slopes (in AoA).
- Redmond loam, 0 to 2 percent slopes.
- Redmond sandy loam, 0 to 2 percent slopes.

The deep Deschutes soil is rapidly permeable but is underlain by a very slowly permeable hardpan at a depth of 42 to 54 inches.

The soils of this unit are well suited to irrigation, and all crops common in the Area can be grown successfully on them. Suitable rotations for these soils are the same as those for the soils in capability unit IIs–2. Fertilizer should be applied in amounts indicated by soil tests.

These soils can be leveled as needed for efficient irrigation. Suitable methods of irrigating are the same as those listed for the soils in unit IIs–1.

Wind erosion is controlled in irrigated areas by leaving crop residues on the surface, establishing a sod cover, or keeping bare fields moist during the windy months. Stubble-mulch tillage reduces erosion in dryfarmed areas. Suitable grasses for dryland seeding are crested wheatgrass and Siberian wheatgrass. A large acreage of soils in this unit cannot be used more intensively, because irrigation water is not now available.

#### CAPABILITY UNIT IIs-4

This unit consists of shallow, nearly level, well-drained soils that have a moderately coarse textured surface layer and a gravelly or cobbly loam or clay loam subsoil underlain by a gravelly hardpan. In these soils permeability is moderately slow. The moisture-holding capacity and fertility are low. Erosion is only a slight hazard. The soils are—

- Ayres sandy loam, 0 to 2 percent slopes (in AoA).
- Ayres gravelly sandy loam, 0 to 2 percent slopes (in ArA).

These are good soils for irrigation. They are best suited to shallow-rooted crops but are well or moderately well suited to all crops grown locally. Rotations like those listed for capability unit IIe–5 can be used successfully on these soils. Apply fertilizer according to needs indicated by soil tests.

The soils in this unit are difficult to level because they are shallow. Suitable methods of irrigation are furrows for potatoes and sprinklers, corrugations, and controlled flooding from contour ditches for small grain, hay crops, and pasture.

A small acreage of these soils is dryfarmed, principally to rye for hay. Normally, precipitation is sufficient for annual cropping, but occasionally a year of fallow is necessary. In years when the soil is fallowed, stubble-mulch tillage aids in controlling erosion. Suitable grasses for dryland areas are crested wheatgrass and Siberian wheatgrass.

#### CAPABILITY UNIT IIs-5

The soils in this unit are deep, nearly level, and well drained. These soils occur on flood plains and alluvial fans. They are moderately coarse textured or medium textured in the surface layer and the subsoil, and they are moderately to rapidly permeable. The soils are—

- Courtrock sandy loam, 0 to 2 percent slopes.
- Metolius loam, 0 to 2 percent slopes.
- Metolius sandy loam, 0 to 2 percent slopes.

These soils are well suited to irrigation and, in most places, all the common crops do well on them. In the Dry Creek area, however, potatoes do not grow well on Metolius soils, because frost is a hazard, and in the Lone Pine area some Metolius loam has a high water table that limits the growth of alfalfa.

The soils in this unit have a naturally low supply of organic matter that can be increased by using a rotation in which row crops are grown for 1 or 2 years; wheat, barley, or oats for 1 year; and alfalfa for 4 to 6 years. A mixture of alfalfa and grass or Ladino clover and grass can be substituted for alfalfa in the rotation. Also suitable is a rotation consisting of 2 years of small grain followed by 4 to 6 years of alfalfa, alfalfa and grass, or Ladino clover and grass. Fertilizer should be applied in amounts indicated by soil tests.

The soils of this unit are deep and can be leveled as needed for good management of irrigation water. Furrow irrigation is desirable for potatoes and, where slopes exceed 1 percent, the furrows should be on the contour. Borders or sprinklers are used with small grain, hay crops, and pasture. These crops also can be irrigated by use of corrugations if slopes are more than 1 percent.

#### CAPABILITY UNIT IIc-1

This unit consists of nearly level, deep, well-drained soils on flood plains. These soils are medium textured or

moderately coarse textured in the surface layer and the subsoil. Their permeability is moderate, and their moisture-holding capacity and fertility are high. The risk of erosion is only slight. The soils are—

Powder loam.
Powder sandy loam.

These soils are well suited to irrigation, and all crops common in the Area can be grown successfully on them (fig. 5).

Although the organic-matter content is naturally low in these soils, it can be increased by using a rotation consisting of 1 or 2 years of row crops, 1 year of small grain, and 4 to 6 years of alfalfa. Small grains suitable in the rotation are wheat, barley, and oats. A mixture of alfalfa and grass or of Ladino clover and grass can be substituted for the alfalfa. Another satisfactory rotation is 2 years of small grain followed by 4 to 6 years of alfalfa, grass and alfalfa, or grass and Ladino clover. Fertilizer should be applied according to needs indicated by soil tests.

The soils of this unit are deep enough for heavy cuts to be made in areas where leveling is needed to improve irrigation. Furrows are most suitable for irrigating potatoes, preferably on the contour if slopes exceed 1 percent. Borders or sprinklers are good methods of irrigation for small grain and for alfalfa and other crops grown for hay or pasture, but corrugations can be used on slopes greater than 1 percent.

#### CAPABILITY UNIT IIIe-1

This unit consists of well-drained, moderately coarse textured soils that occupy slopes of 6 to 12 percent and are 18 to 42 inches deep. In these soils permeability is rapid or moderately rapid, and the moisture-holding capacity and fertility are moderate. Erosion is a severe hazard. The soils are—

Deschutes sandy loam, 6 to 12 percent slopes.
Prineville sandy loam, 6 to 12 percent slopes.

These soils are fairly suitable for irrigation, though they are difficult to irrigate because of slope. They are poorly suited to potatoes and other row crops but are moderately well or well suited to other crops grown in the survey area. Suitable rotations are (a) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa or alfalfa-grass; and (b) 1 or 2 years of grain and 4 to 6 years of Ladino clover and grass. Fertilize in amounts indicated by soil tests. Sprinkler irrigation is best for irrigating small grain, grasses, and legumes.

In dryland areas the soils are suited only as range. To help native plants maintain their vigor, limit grazing to spring and fall. Crested wheatgrass and Siberian wheatgrass are suitable for dryland seeding.

#### CAPABILITY UNIT IIIe-2

In this unit are well-drained, sloping soils that are 42 to more than 60 inches deep. Slopes range from 6 to 12 percent. These soils have a moderately coarse textured surface layer and a moderately coarse textured or medium-textured subsoil. Permeability ranges from moderate to rapid, and the moisture-holding capacity and fertility are moderate. The erosion hazard is moderate or severe. The soils are—

Courtrock sandy loam, 6 to 12 percent slopes.
Courtrock gravelly sandy loam, 6 to 12 percent slopes.
Metolius sandy loam, 6 to 12 percent slopes.
Prineville sandy loam, thick surface, 6 to 12 percent slopes.

In the Prineville soil, a fine sandy loam to loamy sand subsoil is underlain by a hardpan. The other soils have a substratum of porous sand or gravel.

Because the soils in this unit are sloping, they are difficult to irrigate, and their suitability for irrigation is only fair. The soils are best used for pasture. They are moderately well suited to alfalfa and small grain but are poorly suited to potatoes. Adequate rotations are (a) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa alone or in mixture with grass; and (b) 1 or 2 years of small grain and 4 to 6 years of Ladino clover and grass. Fertilizer should be applied according to needs indicated by soil tests.

Sprinklers are most suitable for irrigating small grain, legumes, and grasses, but controlled flooding from contour ditches can be used if slopes do not exceed 8 percent.

Some areas of these soils are dryfarmed to small grain. A farming system of grain alternated with summer fallow is effective in minimizing soil losses where stubble mulching is used during the fallow perod. Crested wheatgrass and Siberian wheatgrass are suitable for seeding dryland areas.

#### CAPABILITY UNIT IIIe-3

This unit consists of shallow to deep, well-drained soils that have a moderately coarse textured or medium-textured surface layer over a medium-textured or moderately fine textured subsoil. The slopes are 6 to 12 percent. In these soils permeability is moderate or moderately slow, and the moisture-holding capacity and fertility range from low to high. Erosion is a moderate or severe hazard. The soils are—

Ayres sandy loam, 6 to 12 percent slopes.
Ayres sandy loam, 6 to 12 percent slopes (in AoC).
Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes.
Ochoco sandy loam, 6 to 12 percent slopes.
Ochoco sandy loam, 6 to 12 percent slopes (in AoC).
Ochoco gravelly sandy loam (6 to 12 percent slopes) (in ArD).
Polly loam, 6 to 12 percent slopes.
Polly gravelly loam, 6 to 12 percent slopes.
Polly sandy loam, thick surface, 6 to 12 percent slopes.

These sloping soils are difficult to irrigate, and their suitability for irrigation is only fair. Although the soils are poorly suited to potatoes and other row crops, they are moderately well or well suited to other crops commonly grown. Suitable rotations are (a) 1 or 2 years of small grain followed by 4 to 6 years of alfalfa or alfalfa and grass; and (b) 1 or 2 years of small grain and 4 to 6 years of Ladino clover and grass. Fertilizer should be applied in amounts indicated by soil tests.

Except for the Polly soils, these soils are difficult to level because of their slope and restricted depth. In Polly soils the cuts can be deeper, though leveling is somewhat limited by slope. Small grain, legumes, and grasses are best irrigated through sprinklers, but they can be irrigated by controlled flooding from contour ditches if slopes do not exceed 8 percent.

Wind erosion in irrigated areas can be reduced by using suitable crop rotations and by keeping the soil moist during the windy season. In dryland areas stubble mulching helps to control blowing and washing. Plants suitable for seeding range and dryland fields are pubescent wheatgrass and alfalfa on the Polly soils and crested wheatgrass and Siberian wheatgrass on the other soils.

*Figure 5.*—**Powder loam, if irrigated, is well suited to all crops grown in the Prineville Area. Behind the trees is a terrace escarpment separating the Powder soil from an area of Ochoco and Prineville soils. Barnes Butte (upper left) is occupied mainly by the Searles soils.**

#### CAPABILITY UNIT IIIe-4

Soils in this unit are well drained and are 12 to 30 inches deep over a gravelly hardpan. They have a medium-textured or moderately coarse textured surface layer and a medium- to fine-textured subsoil. Permeability is moderately slow or slow, and the moisture-holding capacity and fertility are low. The soils are moderately or severely erodible if not protected. They are—

Ayres gravelly sandy loam, 6 to 12 percent slopes.
Ayres gravelly sandy loam (6 to 12 percent slopes) (in ArD).
Lamonta gravelly loam, 6 to 12 percent slopes.

The sloping soils are fairly suitable for irrigation, but they are difficult to irrigate. Because the rooting zone is limited by hardpan in the Ayres soils and by a clay subsoil in the Lamonta soil, the soils of the unit are best suited to shallow-rooted plants used for pasture. They are moderately well suited to small grain and, for the most part, to plants grown for hay and pasture, but the Lamonta soil is poorly suited to alfalfa. All the soils are poorly suited to potatoes and other row crops.

A good rotation is 1 or 2 years of small grain followed by 5 or 6 years of Ladino clover and grass. Fertilizer should be applied according to needs indicated by soil tests. On seedings of irrigated hay or pasture, heavy applications of nitrogen stimulate the grasses and thereby tend to decrease the growth of legumes, whereas additions of phosphate and sulfur increase the growth of legumes.

If these soils are leveled, cuts should be made carefully because the depth of usable soil is limited. Sprinkler irrigation is most suitable, but water can be applied by controlled flooding from contour ditches if slopes are not more than 8 percent. Suitable grasses for dryland seedings are crested wheatgrass and Siberian wheatgrass.

#### CAPABILITY UNIT IIIw-1

In this unit are moderately deep or deep, well-drained to poorly drained soils that occur on flood plains or in low areas on terraces and have a high water table during much of the growing season. Permeability is moderate or moderately slow in these soils. The moisture-holding capacity and fertility are moderate to high. There is little or no erosion hazard. The soils are—

Boyce loam, light-colored variant.
Boyce silt loam.
Boyce silty clay loam.
Ochoco sandy loam, seeped, 0 to 2 percent slopes.

Some areas of these soils are slightly affected by alkali, and the lowest areas of the Boyce soils are subject to flooding in spring.

The soils of this unit are best suited to grasses and legumes for hay and pasture. Meadow foxtail and alsike clover make up a good mixture for inadequately drained areas. Unless drainage is improved, the soils are poorly suited to potatoes and alfalfa. If they are drained and leveled, however, and if alkali areas are improved by leaching and applying gypsum or sulfur, these soils produce high yields of alfalfa and are suited to a rotation of small grain followed by alfalfa or alfalfa-grass or by a mixture of Ladino clover and grass.

If the soils are drained and alkali is removed, suitable kinds of irrigation are the border and the sprinkler methods. On slopes of more than 1 percent, water can be safely applied by use of corrugations. In undrained areas irrigation is generally not needed, though crops may benefit from water added by sprinkling.

#### CAPABILITY UNIT IIIw-2

This unit consists of imperfectly drained, pumiceous, mainly sandy soils that are affected by alkali. These soils contain an excessive amount of sodium, and generally they are very strongly alkaline. Their fertility and moisture-holding capacity are low to moderate. Erosion is a slight or moderate hazard. The soils are—

Crooked loam, 0 to 2 percent slopes.
Crooked loam (in Sm).
Crooked loamy sand, 0 to 2 percent slopes.
Crooked sandy loam, 0 to 2 percent slopes.
Crooked sandy loam, 2 to 6 percent slopes.
Forester loamy sand.
Forester sandy loam.

The Crooked soils are shallow or moderately deep to hardpan, and the Forester soils are deep.

The soils of this unit are best used for hay or pasture. Unless they are reclaimed, however, they are suited only to plants that tolerate alkali. If drainage is improved and the soils are leveled, the alkali content can be lowered by applying manure or other organic matter, using gypsum or sulfur, and leaching with large amounts of water. After reclamation, a suitable crop rotation is 1 or 2 years of small grain followed by 5 or 6 years of strawberry clover mixed with alta fescue or meadow foxtail. Alfalfa alone or alfalfa and grass can be substituted for the clover-grass mixture. Also suitable is any rotation that keeps the soils in hay or pasture most of the time.

Reclamation is easiest on the Forester soils and is most difficult and most expensive on Crooked loam. Reclaiming the Crooked soils is hastened if the pan is broken by chiseling, but adequate amounts of irrigation water are needed to keep salts and alkali from accumulating in the surface layer. Level basins, level borders, or sprinklers are generally used for small grain and for pasture and hay crops, but on Crooked sandy loam, 2 to 6 percent slopes, irrigating through sprinklers or by controlled flooding gives the best results. Where reclamation is inadequate or irrigation water is limited, tall wheatgrass is an alkali-tolerant grass well suited to hay or pasture.

#### CAPABILITY UNIT IIIs-1

The soils in this unit are nearly level or gently sloping, moderately deep or deep, and well drained or somewhat excessively drained. These soils have upper layers of pumiceous loamy sand. They are low to moderate in moisture-holding capacity and fertility. The soils are—

Deschutes loamy sand, 0 to 2 percent slopes.
Deschutes loamy sand, 2 to 6 percent slopes.
Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes.
Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes.
Metolius loamy sand, 0 to 2 percent slopes.
Metolius loamy sand, 2 to 6 percent slopes.
Ochoco loamy sand, 2 to 6 percent slopes.

These soils have fair to good suitability for irrigation; they are well suited to all irrigated crops grown in the Area. A suitable rotation is (a) 1 year of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa or alfalfa and grass; or (b) 1 year of small grain followed by 4 to 6 years of Ladino clover and grass. Fertilizer should be applied according to needs indicated by soil tests.

Potatoes can be irrigated by use of sprinklers or furrows on slopes of less than 1 percent and by contour furrows on slopes between 1 and 4 percent. Grain, hay crops, and pasture can be irrigated through sprinklers or by controlled flooding from contour ditches. In addition, borders are suitable if slopes do not exceed 2 percent.

To control wind erosion in irrigated fields, carefully rotate crops, maintain crop residues on the surface, use minimum tillage, and keep the soil moist during windy periods. In areas of dryland farming, wind erosion is kept to the minimum if the soils are stubble mulched and if alternate strips of grain and fallow are laid out across the prevailing wind. Suitable grasses for seeding dryland areas are crested wheatgrass and Siberian wheatgrass.

#### CAPABILITY UNIT IIIs-2

This unit consists of well-drained or somewhat excessively drained soils that are 18 to more than 60 inches deep. These soils occupy flood plains and alluvial fans in high, narrow valleys where the growing season is short and the hazard of frost is severe. They have low to moderate fertility and moderate or moderately rapid permeability. Their moisture-holding capacity ranges from low to moderate, depending on depth and texture. The erosion hazard is none to moderate. These soils are—

Steiger sandy loam.
Veazie loam.
Veazie loam (in Vr).
Veazie loam, shallow.
Veazie gravelly loam.

These soils generally are nearly level, but some areas of the Steiger soil are gently sloping.

The soils of this unit are well suited to irrigation. In most places, however, use is limited mainly to hay and pasture because frost is a hazard. Small grain can be used in reestablishing stands of alfalfa, alfalfa and grass, or

Ladino clover and grass. Fertilizer should be applied in amounts indicated by soil tests. Suitable methods of irrigation are by borders, corrugations, sprinklers, and controlled flooding from contour ditches.

#### CAPABILITY UNIT IVe-1

This unit consists of shallow to deep, well-drained soils that have moderately slow to rapid permeability. Slopes range from gentle to moderately steep. These soils are low to moderate in fertility and moisture-holding capacity. Under irrigation, they are subject to moderate or severe erosion. The soils are—

- Ayres sandy loam, 12 to 20 percent slopes (in AoD).
- Ayres gravelly sandy loam (12 to 20 percent slopes) (in ArD).
- Metolius sandy loam, 12 to 20 percent slopes.
- Ochoco sandy loam, 12 to 20 percent slopes (in AoD).
- Ochoco gravelly sandy loam (12 to 20 percent slopes) (in ArD).
- Prineville gravelly sandy loam, 6 to 20 percent slopes.
- Slayton sandy loam, 2 to 20 percent slopes.
- Slayton sandy loam, 2 to 20 percent slopes (in SfD).

These soils are fair to very poor for irrigation. Their best use is range or irrigated pasture. In many places the Ayres, Ochoco, and Prineville soils have short slopes. Most of the Metolius soil occurs above existing irrigation canals.

For irrigated pasture a mixture of Ladino clover and alta fescue or orchardgrass can be used, and the best method of irrigation is sprinklers. Grasses suitable for seeding dryland areas are crested wheatgrass and Siberian wheatgrass.

#### CAPABILITY UNIT IVw-1

The only soil in this unit, Swartz silt loam, occurs in basins that have no outlet and is imperfectly drained. It has a clay or silty clay subsoil that seals tightly when wet and cracks as it dries. Runoff is very slow, and there is no erosion hazard. The soil is slowly permeable and has low moisture-holding capacity and fertility.

Most of this soil is not cultivated. The lowest areas can be used for crops if excess water is removed by ditching or pumping. Suitable rotations are (a) 1 or 2 years of potatoes, 1 year of small grain, and 4 to 6 years of alfalfa and grass; and (b) 1 or 2 years of small grain followed by 4 to 6 years of Ladino clover and grass. Fertilize according to needs indicated by soil tests.

Furrows or sprinklers are suitable for irrigating potatoes. Borders or sprinklers are suitable for small grain, hay crops, and pasture, but corrugations or controlled flooding from contour ditches also can be used where slopes are more than 1 percent.

#### CAPABILITY UNIT IVw-2

Only Ontko clay loam and clay are in this unit. They are deep, poorly drained, and moderately fine textured or fine textured in the surface layer and subsoil. In spring they are frequently flooded, but there is little or no erosion hazard. Permeability is moderately slow or slow, fertility is high, and the moisture-holding capacity is very high.

These soils are difficult or very difficult to work because they are clayey and wet. Ditches or tile lines are needed to improve drainage. Pasture or hay crops are best suited, but small grain can be used as a companion crop in establishing stands of hay or pasture. A suitable mixture consists of alsike clover and meadow foxtail or alta fescue. Fertilizer should be applied according to needs indicated by soil tests.

Borders and sprinklers are suitable methods of irrigation. In addition, slopes of more than 1 percent can be irrigated by use of corrugations or controlled flooding from contour ditches.

#### CAPABILITY UNIT IVw-3

The only soil in this unit, Stearns silt loam, is mapped alone and also in the Stearns-Crooked complex (Sm). This soil is imperfectly drained and slowly permeable. It has a silty clay loam subsoil underlain by a cemented hardpan at a depth of 12 to 30 inches. The soil contains excess sodium, in most places is very strongly alkaline, and puddles and seals over when wet. This interferes with the germination of seeds and the emergence of seedlings (fig. 6). The root zone is shallow, and the water-holding capacity and fertility are low. Erosion is only a slight hazard.

This soil is naturally affected by alkali, some areas more strongly than others. Greasewood and patches of saltgrass generally make up the plant cover on areas that contain the most alkali. Reclaiming these areas may not be feasible, but seeding them to tall wheatgrass is desirable. To obtain a good stand of grass, seedings should be made when the surface layer has a favorable content of moisture.

Areas less strongly affected by alkali can be reclaimed and used for crops if adequate drainage is provided. Other practices needed are leveling, leaching with a large amount of water, applying manure or other organic matter, using gypsum or sulfur, and fertilizing according to needs indicated by soil tests. Reclamation requires a large supply of good water. For reclaimed areas suitable crops are pasture, alfalfa, and small grain; suitable methods of applying water are border and sprinkler irrigation.

#### CAPABILITY UNIT IVs-1

In this unit are pumiceous loamy sands that are sloping to moderately steep, moderately deep to very deep, and somewhat excessively drained. These soils have very rapid permeability and are low in moisture-holding capacity and fertility. The erosion hazard is severe. The soils are—

- Deschutes loamy sand, 6 to 20 percent slopes.
- Metolius loamy sand, 6 to 12 percent slopes.

Because of slope and coarse texture, these soils have poor to fair suitability for irrigation. They are best suited to irrigated pasture or range. If water is applied through sprinklers, however, the soils are suited to a rotation of small grain and alfalfa or alfalfa and grass. Sprinkler irrigation can also be used in establishing pasture of Ladino clover and grass. For irrigating well-sodded pasture, controlled flooding from contour ditches can be used.

Fertilizer should be applied in amounts indicated by soil tests. To help control wind erosion, keep bare areas moist during the windy season. Crested wheatgrass and Siberian wheatgrass are suitable for seeding dryland areas.

#### CAPABILITY UNIT IVs-2

This unit is made up of shallow to deep, well-drained or somewhat excessively drained stony soils on slopes of 0 to 6 percent. Because these soils are stony, they are difficult to work. They have very rapid to moderately slow permeability, and their moisture-holding capacity

*Figure 6.*—**Stearns silt loam is affected by alkali and is difficult to reclaim. The surface puddles and seals over when wet. As the soil dries, cracks form in the surface layer and even in the subsoil.**

and fertility are low to moderate. Runoff causes a slight to moderate hazard of erosion. The soils are—

Ayres stony sandy loam, 0 to 6 percent slopes.
Ayres stony sandy loam, 0 to 6 percent slopes (in AsB).
Courtrock stony sandy loam, 2 to 6 percent slopes.
Deschutes stony loamy sand, 0 to 6 percent slopes.
Deschutes stony sandy loam, 0 to 2 percent slopes.
Deschutes stony sandy loam, 2 to 6 percent slopes.
Ochoco stony sandy loam, 0 to 6 percent slopes (in AsB).
Redmond stony loam, 0 to 6 percent slopes.
Redmond stony sandy loam, 0 to 6 percent slopes.

Under irrigation these soils are best suited to pasture, but they also are suited to hay, though stones interfere with harvesting. Suitable plants are Ladino clover, alfalfa, and grass. A small grain can be used as a companion crop in establishing stands of pasture or hay. Suitable methods of irrigation are the sprinkler method and controlled flooding from contour ditches.

In dryland areas crested wheatgrass and Siberian wheatgrass can be grown on these soils.

### CAPABILITY UNIT Vw-1

In this unit are very poorly drained soils in depressional areas that have water on or near the surface during much of the year. These soils are moderately slow or slow in permeability, but they are highly fertile and have high or very high moisture-holding capacity. Root growth is moderately deep or deep. Erosion is not a problem. The soils are—

Boyce silt loam, ponded.
Ontko clay loam, ponded.

Draining these soils is generally not feasible, because of their low position. Reed canarygrass or other water-tolerant grasses of high forage value can be grown if culms are planted.

#### CAPABILITY UNIT VIe-1

This unit consists of nearly level to steep, well-drained, stony or channery soils that are shallow to deep over bedrock or hardpan. Permeability is rapid to slow, and the moisture-holding capacity and fertility are low. Erosion is a slight to severe hazard. The soils are—

Ayres gravelly sandy loam, 20 to 40 percent slopes (in ArE).
Ayres stony sandy loam, 6 to 20 percent slopes.
Courtrock stony sandy loam, 6 to 20 percent slopes.
Deschutes stony sandy loam, 6 to 20 percent slopes.
Lamonta stony loam, 6 to 20 percent slopes.
Lookout stony loam, 0 to 6 percent slopes.
Lookout stony loam, 6 to 20 percent slopes.
Ochoco gravelly sandy loam, 20 to 40 percent slopes (in ArE).
Searles stony loam, 2 to 20 percent slopes.
Searles stony loam, 6 to 40 percent slopes (in GgE).
Searles stony loam, 20 to 40 percent slopes.
Searles stony clay loam, 6 to 20 percent slopes.
Searles stony sandy loam, 6 to 20 percent slopes.
Searles stony sandy loam, 2 to 20 percent slopes (in SfD).
Searles stony sandy loam, 20 to 40 percent slopes.
Searles stony sandy loam, 20 to 40 percent slopes (in SfE).
Slayton channery sandy loam, 2 to 20 percent slopes.
Slayton channery sandy loam, 20 to 40 percent slopes.
Slayton channery sandy loam, 20 to 40 percent slopes (in SfE).

These soils are not suitable for irrigation or for dry-farming. In undisturbed areas the plant cover consists mainly of bluebunch wheatgrass, Sandberg bluegrass, needlegrass, sagebrush, and juniper. If range or pasture is properly managed, grazing is limited to spring and fall. In places where reseeding is needed, crested wheatgrass and Siberian wheatgrass are suitable.

#### CAPABILITY UNIT VIe-2

This unit consists of shallow to deep, well-drained, stony soils that have a clayey subsoil. Slopes range from 6 to 40 percent. These soils have slow to rapid runoff and are moderately or highly susceptible to erosion. Permeability is moderately slow, and the moisture-holding capacity and fertility are low to moderate. The soils are—

Gem stony loam, 6 to 20 percent slopes.
Gem stony loam, 6 to 40 percent slopes (in GgE).
Gem stony clay loam, 12 to 40 percent slopes (in GcE).
Polly stony loam, 6 to 20 percent slopes.

These soils are not suitable for irrigation farming. If undisturbed, the native plant cover consists mainly of Idaho fescue, bluebunch wheatgrass, bitterbrush, and sagebrush. On properly managed range or pasture, grazing is limited to spring and fall, but the period of use in spring is later on these soils than on the soils in capability unit VIe-1. Plants suitable for seeding are pubescent wheatgrass and alfalfa.

#### CAPABILITY UNIT VIIs-1

This unit consists mainly of nearly level to steep, shallow or moderately deep soils that are very stony or very rocky and are well drained. On these soils runoff is very slow to rapid, permeability is moderate to slow, and the erosion hazard is slight to severe. The moisture-holding capacity and fertility are low to moderate. The soils are—

Agency very stony sandy loam, 6 to 40 percent slopes.
Day clay, 6 to 40 percent slopes.
Day clay, 12 to 40 percent slopes (in GcE).
Lookout very stony loam, 0 to 40 percent slopes.
Redmond very stony sandy loam, 6 to 12 percent slopes.
Rock land.

These soils are not suited to cultivated crops and are not well suited to seeded grasses. Carefully managing the native plants is the best way to maintain or to improve the condition of range (fig. 7). In undisturbed areas the plant cover is dominantly bluebunch wheatgrass, Sandberg bluegrass, sagebrush, and juniper. On north-facing slopes Idaho fescue is abundant, and the proper season of use is late in spring and in fall. Other slopes are properly used if grazed carefully in spring and fall.

#### CAPABILITY UNIT VIIs-2

This unit consists of nearly level to moderately steep, well-drained or somewhat excessively drained soils that are 6 to 24 inches deep. These soils are very stony and commonly are called scabland. Slopes range from 0 to 20 percent but are 0 to 6 percent in most places. Permeability is rapid to moderately slow, fertility is low, and the moisture-holding capacity is low or very low. Erosion is a slight or moderate hazard. The soils are—

Bakeoven very stony loam, 0 to 20 percent slopes.
Bakeoven very stony sandy loam, 0 to 20 percent slopes.
Bakeoven very stony sandy loam, 0 to 6 percent slopes (in DuB).
Bakeoven very stony sandy loam, 0 to 6 percent slopes (in DvB).
Deschutes very stony sandy loam, 0 to 6 percent slopes (in DuB).

These soils are too stony and generally too shallow for cultivation. In places, however, they are used for pasture made up of volunteer stands of white clover and bluegrass that are irrigated by wild flooding. In other areas the plant cover is sparse and consists mostly of Sandberg bluegrass, juniper, and sagebrush. Reseeding these soils is impractical.

#### CAPABILITY UNIT VIIs-3

This unit consists of well-drained, stony or very stony soils that are very steep or severely eroded and, in places, have outcrops of rock. Slopes range from 20 to 70 percent. These soils have rapid or very rapid runoff and are highly susceptible to erosion. Permeability is slow, and the moisture-holding capacity and fertility are low. The soils are—

Agency very stony sandy loam, 40 to 70 percent slopes.
Searles stony clay loam, 20 to 40 percent slopes, severely eroded.

These soils are too stony and too steep for cultivation or reseeding. The plant cover consists chiefly of bluebunch wheatgrass, Sandberg bluegrass, sagebrush, and juniper, but on north- and east-facing slopes there is nearly as much Idaho fescue as wheatgrass. The soils are suitable for grazing, mainly late in spring and in fall, though their use is limited.

#### CAPABILITY UNIT VIIs-4

The soils in this unit are nearly level to steep, shallow to deep, and very stony. They have very slow to rapid runoff, moderately slow or slow permeability, and low to moderate moisture-holding capacity and fertility. The erosion hazard is slight to severe. The soils are—

Elmore very stony loam, 6 to 40 percent slopes.
Gem very stony loam, 6 to 40 percent slopes.
Salisbury very stony loam, 0 to 6 percent slopes.
Salisbury very stony loam, 6 to 20 percent slopes.

*Figure 7.*—**Native bunchgrasses on an area of Rock land and Deschutes soil.**

These soils are not suited to cultivated crops and are not well suited to seeded plants. The condition of range can best be maintained or improved by properly managing the native vegetation. In undisturbed areas the plant cover is dominantly Idaho fescue, bluebunch wheatgrass, bitterbrush, sagebrush, and juniper. On north-facing slopes, the plants can be safely grazed late in spring and in summer and fall. On other slopes the vegetation is ready for grazing late in spring and in fall.

CAPABILITY UNIT VIIIs-1

This unit consists of land types that are barren in most places. They are—

Borrow pits.
Riverwash.
Riverwash (in Vr).
Rock outcrop.

Shrubs, grasses, and a few trees grow in places on Riverwash.

The land types and soils in this unit have little or no agricultural value. They are used as a source of materia for roads, dams, and other construction.

## Estimated Yields

Table 1 gives the estimated average acre yields of the principal crops grown in the Prineville Area under two levels of management. In columns A are yields that can be expected under average management. In columns B are yields that can be expected under the highest level of management that is now feasible.

These estimates are only for the soils that are suitable for cultivated crops under irrigation. The estimates are averages over a period of years, not yields for any particular year. They are based on observations made during the soil survey and on information obtained from farmers, the county agricultural agent, the Soil Con-

TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are those expected over a period of years under average management; those in columns B, under the best management practical. Absence of yield indicates that crop is not grown under management specified or is not suited to the soil]

| Soil | Alfalfa | | Potatoes | | Clover for seed | | Winter wheat (irrigated) | | Spring wheat (irrigated) | | Barley (irrigated) | | Seeded pasture (irrigated) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| | *Tons* | *Tons* | *Bu.* | *Bu.* | *Lbs.* | *Lbs.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Tons* | *Tons* |
| Ayres gravelly sandy loam, 0 to 2 percent slopes | 2.5 | 4 | 300 | 400 | 400 | 900 | 40 | 60 | 30 | 50 | 50 | 70 | 2.3 | 4 |
| Ayres gravelly sandy loam, 2 to 6 percent slopes | 2.5 | 4.5 | 300 | 400 | 400 | 900 | 40 | 60 | 30 | 50 | 50 | 70 | 2.3 | 4 |
| Ayres gravelly sandy loam, 6 to 12 percent slopes | 2.5 | 4.5 | | 350 | 400 | 850 | 35 | 50 | 30 | 50 | 40 | 55 | 2.3 | 3.8 |
| Ayres sandy loam, 0 to 2 percent slopes | 3.5 | 5 | 325 | 400 | 400 | 1,000 | 50 | 75 | 40 | 65 | 60 | 80 | 2.5 | 4 |
| Ayres sandy loam, 2 to 6 percent slopes | 3.5 | 5 | 300 | 400 | 400 | 1,000 | 45 | 75 | 35 | 60 | 60 | 80 | 2.5 | 4 |
| Ayres sandy loam, 6 to 12 percent slopes | 3 | 5 | | 350 | 400 | 900 | 40 | 60 | 30 | 50 | 50 | 70 | 2 | 4 |
| Ayres stony sandy loam, 0 to 6 percent slopes | 2 | 3 | | | 300 | 500 | 40 | 50 | 35 | 45 | 45 | 70 | 2 | 4 |
| Ayres stony sandy loam, 6 to 20 percent slopes | 2 | 3 | | | 200 | 400 | 40 | 50 | 35 | 45 | 45 | 65 | 1.8 | 3.8 |
| Boyce silty clay loam | | 5.5 | | 400 | | 1,000 | 35 | 60 | | 70 | | 90 | 2.5 | 4 |
| Boyce silt loam | | 6 | | 400 | 400 | 1,000 | 40 | 80 | | 65 | | 90 | 2 | 5 |
| Boyce silt loam, ponded | | | | | | | | | | | | | | 5 |
| Boyce loam, light-colored variant | | 6 | | 400 | | 1,000 | | 80 | | 60 | | 80 | 1.5 | 4.5 |
| Courtrock sandy loam, 0 to 2 percent slopes | 4 | 6 | 350 | 500 | 400 | 1,100 | 60 | 80 | 40 | 80 | 75 | 95 | 3.5 | 5 |
| Courtrock sandy loam, 2 to 6 percent slopes | 3.5 | 5 | 350 | 450 | 400 | 1,100 | 55 | 80 | 40 | 80 | 70 | 90 | 3.5 | 5 |
| Courtrock sandy loam, 6 to 12 percent slopes | | 3.5 | | | 400 | 800 | 35 | 65 | 35 | 60 | 40 | 75 | 3 | 5 |
| Courtrock gravelly sandy loam, 0 to 2 percent slopes | 3 | 4.5 | 325 | 400 | 600 | 1,000 | 45 | 75 | 35 | 65 | 45 | 80 | 3 | 4.3 |
| Courtrock gravelly sandy loam, 2 to 6 percent slopes | 2.5 | 4.5 | 325 | 400 | 600 | 1,000 | 40 | 75 | 35 | 65 | 40 | 75 | 3 | 4 |
| Courtrock gravelly sandy loam, 6 to 12 percent slopes | | 3.5 | | 350 | 400 | 800 | 30 | 60 | 30 | 55 | 40 | 60 | 2 | 3.5 |
| Courtrock stony sandy loam, 2 to 6 percent slopes | 1.5 | 3 | | | 200 | 600 | 30 | 50 | 30 | 45 | 40 | 50 | 1.8 | 2.8 |
| Crooked sandy loam, 0 to 2 percent slopes | 2 | 4 | | 350 | | 900 | 25 | 50 | 25 | 60 | 30 | 70 | 1.8 | 3.5 |
| Crooked sandy loam, 2 to 6 percent slopes | 2 | 4 | | 350 | | 900 | 25 | 50 | | 60 | | 70 | 1.5 | 3.5 |
| Crooked loamy sand, 0 to 2 percent slopes | 2 | 4 | | 350 | | 800 | 25 | 50 | 25 | 50 | | 70 | 2.5 | 3 |
| Crooked loam, 0 to 2 percent slopes | 2 | 4 | | 350 | | | | 60 | | 45 | | 60 | 1.5 | 4 |
| Deschutes sandy loam, 0 to 2 percent slopes | 3 | 5.5 | 350 | 450 | 600 | 1,000 | 40 | 75 | 35 | 70 | 60 | 80 | 2 | 4.5 |
| Deschutes sandy loam, 2 to 6 percent slopes | 3 | 5 | 350 | 425 | 600 | 1,000 | 40 | 75 | 35 | 70 | 55 | 80 | 2 | 4.5 |
| Deschutes sandy loam, 6 to 12 percent slopes | 2 | 4 | | | | 1,000 | 30 | 50 | 35 | 70 | 40 | 60 | 2.5 | 4 |
| Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes | 3 | 5.5 | 350 | 450 | 600 | 1,000 | 50 | 75 | 45 | 70 | 60 | 90 | 3 | 5 |
| Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes | 3 | 5.5 | 350 | 400 | 600 | 1,000 | 50 | 75 | 50 | 70 | 60 | 85 | 2.5 | 5 |
| Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes | 3.5 | 6 | 325 | 450 | 600 | 1,000 | 50 | 80 | 45 | 75 | 60 | 90 | 2 | 4.5 |
| Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes | 3.5 | 6 | 325 | 450 | 600 | 1,100 | 50 | 80 | 45 | 75 | 60 | 90 | 2 | 4.5 |
| Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes | 2 | 4.5 | | 400 | 400 | 1,000 | 40 | 60 | 35 | 50 | 50 | 60 | 1 | 3 |
| Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes | 3.5 | 6 | 350 | 450 | 600 | 1,200 | 50 | 80 | 45 | 75 | 60 | 90 | 2 | 5.5 |
| Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes | 3 | 5 | 325 | 400 | 600 | 1,000 | 45 | 60 | 40 | 65 | 50 | 70 | 2 | 4.5 |
| Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes | 3 | 5 | 325 | 400 | 600 | 1,000 | 40 | 60 | 40 | 65 | 50 | 70 | 2 | 4 |
| Deschutes stony sandy loam, 0 to 2 percent slopes | 2.5 | 3.5 | | | 400 | 700 | 30 | 50 | 40 | 55 | 40 | 60 | 2 | 4 |
| Deschutes stony sandy loam, 2 to 6 percent slopes | 2.5 | 3.5 | | | 400 | 700 | 30 | 50 | 30 | 45 | 40 | 50 | 2 | 4 |
| Deschutes loamy sand, 0 to 2 percent slopes | 3 | 5 | 350 | 425 | 500 | 1,000 | 40 | 75 | 35 | 60 | 60 | 80 | 2 | 4.5 |
| Deschutes loamy sand, 2 to 6 percent slopes | 3 | 5 | 350 | 425 | 400 | 1,000 | 40 | 70 | 35 | 60 | 55 | 80 | 2 | 4 |
| Deschutes loamy sand, 6 to 20 percent slopes | | 4.5 | | | 200 | 800 | 30 | 60 | 30 | 50 | 30 | 60 | 2 | 4 |
| Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes | 3.5 | 5.5 | 350 | 450 | 600 | 1,100 | 50 | 80 | 35 | 65 | 60 | 90 | 2.5 | 5 |
| Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes | 3 | 5.5 | 350 | 450 | 600 | 1,100 | 50 | 80 | 35 | 65 | 60 | 90 | 2.5 | 4.3 |
| Deschutes stony loamy sand, 0 to 6 percent slopes | 2.5 | 3 | | | 400 | 600 | 30 | 50 | 30 | 45 | 40 | 60 | 1.5 | 3.0 |
| Forester loamy sand | 1.5 | 2.5 | | | | 800 | 25 | 55 | 20 | 50 | 20 | 65 | 1.3 | 3.5 |
| Forester sandy loam | 2 | 3 | | | | 1,000 | 25 | 60 | 25 | 60 | 30 | 75 | 1.8 | 4 |
| Lamonta gravelly loam, 6 to 12 percent slopes | | 4 | | | 400 | 1,000 | 30 | 55 | 30 | 50 | 45 | 80 | | 3.8 |
| Lamonta loam, 0 to 6 percent slopes | 2 | 5 | | | 450 | 1,000 | 45 | 70 | | 60 | | 80 | 1.8 | 5 |
| Lookout loam, 0 to 2 percent slopes | 3 | 4.5 | | | 600 | 1,000 | 30 | 55 | 30 | 45 | 45 | 70 | 2.5 | 4.5 |
| Lookout loam, 2 to 6 percent slopes | 3 | 4.5 | | | 600 | 1,000 | 30 | 55 | 30 | 45 | 45 | 70 | 2.5 | 4.5 |
| Metolius sandy loam, 0 to 2 percent slopes | 3.5 | 5 | 350 | 400 | 600 | 1,000 | 50 | 75 | 40 | 65 | 60 | 95 | 3 | 5 |
| Metolius sandy loam, 2 to 6 percent slopes | 3.5 | 5 | 350 | 400 | 600 | 1,000 | 50 | 75 | 35 | 60 | 60 | 90 | 3 | 5 |
| Metolius sandy loam, 6 to 12 percent slopes | 2.5 | 4 | | 375 | 400 | 1,000 | 45 | 65 | 35 | 60 | 45 | 70 | 2.5 | 4.5 |
| Metolius loamy sand, 0 to 2 percent slopes | 3.5 | 5 | 300 | 350 | 500 | 900 | 50 | 75 | 35 | 60 | 50 | 80 | 3 | 4.5 |
| Metolius loamy sand, 2 to 6 percent slopes | 3.5 | 5 | 300 | 350 | 400 | 900 | 50 | 75 | 35 | 60 | 50 | 80 | 2.8 | 4.5 |
| Metolius loamy sand, 6 to 12 percent slopes | 3 | 5 | | 350 | 300 | 900 | 45 | 60 | 35 | 55 | 45 | 70 | 2.5 | 4.5 |
| Metolius loam, 0 to 2 percent slopes | 5 | 6.5 | 400 | 500 | 700 | 1,200 | 70 | 90 | 50 | 70 | 70 | 110 | 3.8 | 6 |

TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*—Continued

| Soil | Alfalfa | | Potatoes | | Clover for seed | | Winter wheat (irrigated) | | Spring wheat (irrigated) | | Barley (irrigated) | | Seeded pasture (irrigated) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| | *Tons* | *Tons* | *Bu.* | *Bu.* | *Lbs.* | *Lbs.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Tons* | *Tons* |
| Ochoco sandy loam, 0 to 2 percent slopes | 3.5 | 5 | 325 | 450 | 600 | 1,000 | 50 | 75 | 40 | 65 | 60 | 80 | 3 | 5.5 |
| Ochoco sandy loam, seeped, 0 to 2 percent slopes | | 5 | | 400 | 600 | 1,000 | 30 | 75 | 35 | 50 | 40 | 80 | 2 | 4.8 |
| Ochoco sandy loam, 2 to 6 percent slopes | 3.5 | 5 | 325 | 425 | 600 | 1,000 | 45 | 75 | 35 | 60 | 60 | 80 | 3 | 5 |
| Ochoco sandy loam, 6 to 12 percent slopes | 3 | 5 | | 350 | 600 | 1,000 | 40 | 60 | 30 | 50 | 50 | 70 | 3 | 4.5 |
| Ochoco gravelly sandy loam, 0 to 2 percent slopes | 3 | 4.5 | 300 | 400 | 600 | 1,000 | 45 | 60 | 30 | 50 | 50 | 70 | 2.8 | 5 |
| Ochoco gravelly sandy loam, 2 to 6 percent slopes | 2.5 | 4 | 300 | 400 | 600 | 1,000 | 45 | 60 | 30 | 50 | 50 | 70 | 2.5 | 4.5 |
| Ochoco loamy sand, 2 to 6 percent slopes | 3 | 5 | 325 | 400 | 400 | 900 | 45 | 75 | 40 | 65 | 60 | 80 | 2.3 | 4 |
| Ochoco loam, 0 to 2 percent slopes | 3.5 | 5 | 325 | 450 | 600 | 1,000 | 50 | 75 | 40 | 65 | 60 | 80 | 3 | 5.5 |
| Ochoco loam, 2 to 6 percent slopes | 3.5 | 5 | 325 | 425 | 600 | 1,000 | 45 | 75 | 35 | 60 | 60 | 80 | 3 | 5 |
| Ochoco gravelly loam, 2 to 6 percent slopes | 3 | 4.5 | 300 | 400 | 600 | 1,000 | 45 | 70 | 30 | 50 | 60 | 75 | 2.5 | 4.5 |
| Ontko clay loam and clay | | 4.5 | | | | 1,100 | | 70 | | 50 | | 70 | 1.5 | 5 |
| Polly gravelly loam, 0 to 6 percent slopes | 3 | 4.5 | | | 600 | 1,000 | 45 | 60 | 30 | 50 | 50 | 60 | 2.5 | 4.5 |
| Polly gravelly loam, 6 to 12 percent slopes | 3 | 4.5 | | | | | 30 | 50 | 30 | 50 | 45 | 50 | 2.0 | 3.5 |
| Polly loam, 0 to 6 percent slopes | 3 | 4.5 | | | 600 | 1,000 | 45 | 70 | 35 | 50 | 50 | 70 | 2.5 | 4.5 |
| Polly loam, 6 to 12 percent slopes | 3 | 4.5 | | | | | 35 | 50 | 30 | 50 | 50 | 60 | 2.0 | 3.5 |
| Polly sandy loam, 2 to 6 percent slopes | 2 | 4 | 275 | 350 | 500 | 1,000 | 30 | 60 | 30 | 50 | 35 | 60 | 1.8 | 4 |
| Polly sandy loam, thick surface, 2 to 6 percent slopes | 2.5 | 4.5 | 300 | 400 | 450 | 1,000 | 35 | 60 | 30 | 50 | 50 | 70 | 2 | 4.5 |
| Polly sandy loam, thick surface, 6 to 12 percent slopes | 2 | 4 | | 350 | 400 | 1,000 | 35 | 50 | 30 | 45 | 40 | 50 | 2 | 4 |
| Powder loam | 3 | 5.5 | 300 | 400 | 600 | 1,100 | 50 | 80 | 40 | 60 | 60 | 90 | 2.8 | 5.5 |
| Powder gravelly loam | 3 | 5 | | | 400 | 800 | 30 | 50 | 35 | 50 | 40 | 70 | 2 | 4.5 |
| Powder silt loam | 4 | 6 | | 400 | 600 | 1,200 | 50 | 80 | 40 | 65 | 60 | 80 | 2 | 5 |
| Powder silt loam, over gravel | 4 | 6 | | 400 | 500 | 1,000 | 45 | 80 | | | 60 | 80 | 2 | 5 |
| Powder sandy loam | 3 | 5 | 350 | 400 | 600 | 900 | 40 | 70 | 30 | 50 | 55 | 80 | 2.5 | 4.5 |
| Powder fine sandy loam, coarse variant | 2 | 5 | | 400 | 400 | 900 | 30 | 70 | 30 | 50 | 30 | 70 | 1.5 | 4 |
| Powder fine sandy loam, over gravel, coarse variant | 2 | 4.5 | | 300 | 400 | 900 | 30 | 50 | 30 | 50 | 30 | 60 | 1.5 | 4 |
| Prineville sandy loam, 0 to 2 percent slopes | 3.5 | 5 | 350 | 475 | 600 | 1,000 | 50 | 70 | 40 | 65 | 60 | 80 | 3 | 5 |
| Prineville sandy loam, 2 to 6 percent slopes | 3 | 5 | 325 | 450 | 600 | 1,000 | 45 | 70 | 35 | 60 | 60 | 80 | 3 | 5 |
| Prineville sandy loam, 6 to 12 percent slopes | 2 | 3.5 | | 400 | | 800 | 30 | 60 | 30 | 50 | 45 | 70 | 2.5 | 4 |
| Prineville sandy loam, thick surface, 0 to 2 percent slopes | 4 | 5.5 | 400 | 500 | 700 | 1,100 | 50 | 80 | 40 | 65 | 60 | 90 | 3 | 5 |
| Prineville sandy loam, thick surface, 2 to 6 percent slopes | 3.5 | 5.5 | 400 | 500 | 600 | 1,100 | 50 | 80 | 40 | 65 | 60 | 90 | 3 | 5 |
| Prineville sandy loam, thick surface, 6 to 12 percent slopes | 2.5 | 4.5 | | 450 | 600 | 1,000 | 35 | 70 | 30 | 45 | 50 | 80 | 2.3 | 4 |
| Prineville gravelly sandy loam, 2 to 6 percent slopes | 3 | 4.5 | 350 | 400 | 450 | 900 | 40 | 65 | 30 | 55 | 50 | 70 | 2.5 | 4 |
| Prineville gravelly sandy loam, 6 to 20 percent slopes | | | | | | | | | | | | | 1.5 | 3 |
| Redmond sandy loam, 0 to 2 percent slopes | 3 | 5.5 | 350 | 425 | 600 | 1,000 | 60 | 80 | 50 | 60 | 70 | 100 | 3 | 5.5 |
| Redmond sandy loam, 2 to 6 percent slopes | 3 | 5 | 350 | 400 | 600 | 1,100 | 60 | 75 | 50 | 60 | 70 | 95 | 3 | 5 |
| Redmond stony sandy loam, 0 to 6 percent slopes | | | | | | | | | | | | | 2 | 4 |
| Redmond loam, 0 to 2 percent slopes | 3 | 5.5 | 325 | 425 | 650 | 1,100 | 65 | 80 | 50 | 60 | 80 | 100 | 3.5 | 5.5 |
| Redmond stony loam, 0 to 6 percent slopes | | | | | | | | | | | | | 2 | 4 |
| Slayton sandy loam, 2 to 20 percent slopes | | | | | | | 30 | 40 | 30 | 40 | 35 | 45 | 1 | 3 |
| Stearns silt loam | | 3.5 | | | | | 30 | 65 | | 45 | | 50 | 1.3 | 4 |
| Steiger sandy loam | 2 | 3 | | | | | 30 | 40 | 30 | 40 | 30 | 40 | 2.5 | 3.5 |
| Swartz silt loam | 2 | 4.5 | 275 | 350 | 500 | 1,000 | 35 | 60 | 30 | 45 | 45 | 65 | 2 | 4.5 |
| Veazie loam | 3 | 5 | 300 | 350 | 600 | 1,000 | 50 | 70 | 35 | 55 | 60 | 80 | 3 | 5 |
| Veazie loam, shallow | 2.5 | 4 | | | 500 | 1,000 | 40 | 60 | 35 | 50 | 50 | 65 | 2 | 4 |
| Veazie gravelly loam | 2.5 | 4.5 | | | 400 | 1,000 | 40 | 55 | 35 | 50 | 50 | 60 | 2 | 4.8 |

servation Service, and the county Agricultural Stabilization and Conservation committee.

Yields in columns A are obtained under average, or prevailing, management. Under this management a crop rotation is followed, but other practices are not always adequate. Fertilizer is applied, but generally in amounts less than optimum; fields may be poorly prepared for irrigation; soils may be overirrigated because water is not applied carefully; and soils affected by excess water are not properly drained.

To obtain the yields in columns B, a farmer must:

1. Use suitable crop rotations.
2. Plant crop varieties that are suited to the soil and produce high yields.
3. Apply fertilizer according to needs indicated by soil tests.
4. Level the soil for efficient irrigation.
5. Apply water carefully at the right time and in the amounts needed.

6. Use improved machinery for cultivating, planting, and harvesting.
7. Use suitable practices for improving soils affected by salts and alkali.
8. Provide adequate drainage where needed.

Practices are suggested for groups of soils in the subsection "Management by Capability Units."

## Use of Soils in Engineering

Soil surveys are commonly used in engineering work, especially in highway and dam construction and in the hydrological aspects of watershed planning and construction. A knowledge of the physical properties of soils is needed to predict the behavior of soils in engineering as well as in agriculture. Determining the engineering properties of different soil types by laboratory tests can reduce the need for more costly and time-consuming tests at new or proposed sites for engineering structures.

The information in this report can be used to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that are significant in planning agricultural drainage and irrigation systems, farm ponds, and terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway, airport, pipeline, and cable locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soils and thus gain information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be readily used by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in those situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

This subsection of the report provides engineers with engineering test data for some of the main soils in the Prineville Area and with the estimated physical properties and qualities of untested soils as determined by interpreting soil survey data.

Some terms used by the agricultural soil scientist may be unfamiliar to the engineer, and some terms may have special meaning in soil science. These terms are defined in the Glossary at the end of this report.

### *Engineering classification systems*

Two systems are used to classify soils according to their engineering properties, that of the American Association of State Highway Officials, the AASHO system (*1*), and that developed by the Corps of Engineers, U.S. Army, the Unified system (*17*).

In the AASHO system, the soils are grouped according to their load-bearing capacity and service into seven basic groups, designated A–1 through A–7. The best soils for road subgrades are classified as A–1, and the poorest as A–7. Within each group the relative engineering value of the soil material can be indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol; for example, A–4(1). It is given for the soil samples on which engineering tests were made (see table 2, p. 26).

In the Unified classification, the soils are grouped on the basis of their texture and plasticity. This system is less detailed than the AASHO system, but the two are enough alike so that a soil classified according to one can be readily classified according to the other. The Unified system recognizes eight classes of coarse-grained soils, six classes of fine-grained soils, and highly organic soils. Coarse-grained soils are those that have 50 percent or less of material passing the No. 200 sieve; fine-grained soils are those that have more than 50 percent of material passing the No. 200 sieve. Coarse-grained material is identified as gravel (G) or sand (S), the two of which are placed in eight secondary groups—GW, GP, GM, GC, SW, SP, SM, and SC. These secondary groups are based on the amount and kind of fines and the shape of the grain-size distribution curve.

Depending on their liquid limit and plasticity index, fine-grained soils are divided into silts (M) and clays (C). Each of these is divided into two secondary groups —MH or CH if the liquid limit is greater than 50, and ML or CL if it is less than 50. Also recognized in the Unified system are organic silts (OL), organic clays (OH), and peat or other highly organic soils (Pt).

### *Engineering test data*

Table 2 gives engineering test data for soil samples taken from seven soil profiles in the survey area. The tests were performed by the Bureau of Public Roads in accordance with standard AASHO procedures. Results of mechanical analyses made by this method frequently differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material, or that passing the No. 200 sieve, is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters but not larger than 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded

TABLE 2.—*Engineering test data* [1] *for*

[Tests performed by Bureau of Public Roads (BPR) in accordance with standard

| Soil name and location | Parent material | BPR report number | Depth | Horizon | Moisture-density: Maximum dry density | Moisture-density: Optimum moisture | Mechanical analysis [2]: Estimated percentage larger than 3 inches discarded in field sampling | Percentage passing sieve [3]— 3-in. | 2-in. | 1½-in. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S-30 | Inches | | Lb. per cu. ft. | Percent | | | | |
| Ayres gravelly sandy loam: SE¼SE¼SE¼ sec. 19, T. 15 S., R. 15 E. | Colluvium. | 267 | 0–8 | A1 and A3 | 100 | 19 | ------ | ------ | 100 | 96 |
| | | 268 | 8–14 | B2t | 95 | 23 | 10 | 90 | 90 | 71 |
| Day clay: SE¼NE¼NE¼ sec. 7, T. 14 S., R. 16 E. | Clays of John Day formation. | 271 | 0–3 | A1 | 81 | 32 | ------ | ------ | ------ | ------ |
| | | 272 | 3–31 | AC and C1 | 83 | 28 | ------ | ------ | ------ | ------ |
| | | 273 | 31–96 | C2ca and C3. | 81 | 37 | ------ | ------ | ------ | ------ |
| Deschutes loamy sand: SE¼NE¼NE¼ sec. 19, T. 16 S., R. 14 E. | Dacite pumice over basalt. | 274 | 0–10 | A1 and A3 | 95 | 20 | ------ | ------ | ------ | ------ |
| | | 275 | 10–17 | B2 | 93 | 21 | ------ | ------ | ------ | ------ |
| | | 276 | 17–30 | Cca and IIR. | 108 | 16 | ------ | ------ | ------ | ------ |
| Deschutes sandy loam (deep phase): NE¼NW¼NE¼ sec. 2, T. 16 S., R. 14 E. | Dacite pumice over alluvium. | 277 | 0–24 | Ap, A3, and B2. | 95 | 21 | ------ | ------ | ------ | ------ |
| | | 278 | 24–50 | IICca | 116 | 14 | 50 | 50 | 44 | 33 |
| Lamonta gravelly loam: NW¼NE¼SW¼ sec. 32, T. 13 S., R. 15 E. | Alluvium in fans. | 285 | 0–9 | Ap and B1t. | 104 | 18 | ------ | ------ | ------ | 100 |
| | | 286 | 9–20 | B21t and B22t. | 77 | 40 | 10 | 90 | 90 | 90 |
| Searles stony clay loam: NW¼NW¼NW¼ sec. 32, T. 14 S., R. 15 E. | Clarno tuff. | 279 | 0–7 | A1 and A3 | 87 | 27 | 30 | 70 | ------ | 70 |
| | | 280 | 7–14 | B2t | 81 | 36 | ------ | ------ | ------ | 100 |
| | | 281 | 14–36 | B3ca and Cca. | 72 | 44 | ------ | ------ | ------ | ------ |
| Swartz silt loam: SE¼SW¼SE¼ sec. 34, T. 14 S., R. 15 E. | Alluvium. | 287 | 0–5 | A1 and A2 | 101 | 20 | ------ | ------ | ------ | ------ |
| | | 288 | 5–32 | B21t, B22t, and B3. | 79 | 35 | ------ | ------ | ------ | ------ |
| | | 289 | 32–45 | C1 | 83 | 32 | ------ | ------ | ------ | ------ |

[1] Based on AASHO Designation: T 99–57, Method A (*1*).

[2] Mechanical analysis according to AASHO Designation: T 88–57(*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

from calculations of grain-size fractions. A comparison of these and other systems of size limits for soil separates can be found in the PCA Soil Primer (*6*). Table 2 shows both the AASHO and the Unified classifications.

### *Estimated physical properties of untested soils*

Table 3 gives the estimated physical properties and qualities of untested soils, as determined by interpreting soil survey data. The estimates for liquid limit and plasticity index were based largely on clay content. The estimates were checked with the estimates for optimum moisture and maximum dry density, which also are closely related to the amounts of various particle sizes.

## *Descriptions of Soils*

This section describes the soil series (groups of soils) and single soils (mapping units) of the Prineville Area. The acreage and proportionate extent of each mapping unit are given in table 4.

The procedure in this section is to describe first the soil series and then the mapping units in that series.

*soil samples taken from seven soil profiles*

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

| Mechanical analysis [2]—Continued | | | | | | | | | | | | Liquid limit | Plasticity index | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage passing sieve [3]—Continued | | | | | | | | Percentage smaller than [3]— | | | | | | | |
| 1-in. | ¾-in. | ⅜-in. | No. 4 (4.7 mm.) | No. 10 (2.0 mm.) | No. 40 (0.42 mm.) | No. 60 (0.25 mm.) | No. 200 (0.074 mm.) | 0.05 mm. | 0.02 mm. | 0.005 mm. | 0.002 mm. | | | AASHO [4] | Unified [5] |
| 94 | 90 | 86 | 84 | 83 | 74 | 62 | 39 | 33 | 25 | 17 | 12 | 29 | 2 | A-4(1) | SM. |
| 68 | 65 | 64 | 63 | 62 | 58 | 53 | 42 | 40 | 32 | 26 | 20 | 37 | 13 | A-6(1) | GM-GC. |
| | | | 100 | 99 | 97 | 95 | 90 | 88 | 80 | 71 | 66 | 76 | 32 | A-7-5(20) | MH. |
| | | | 100 | 99 | 96 | 95 | 90 | 88 | 77 | 66 | 60 | 74 | 37 | A-7-5(20) | MH. |
| | | | | 100 | 99 | 96 | 90 | 79 | 66 | 57 | 51 | 97 | 51 | A-7-5(20) | MH. |
| 100 | 99 | 98 | 98 | 98 | 85 | 69 | 43 | 34 | 23 | 15 | 11 | [6] | [6] | A-4(2) | SM. |
| | 100 | 99 | 99 | 99 | 83 | 63 | 34 | 27 | 17 | 10 | 8 | [6] | [6] | A-2-4(0) | SM. |
| 100 | 98 | 97 | 96 | 94 | 85 | 79 | 56 | 42 | 24 | 11 | 7 | [6] | [6] | A-4(4) | ML. |
| 100 | 98 | 95 | 93 | 91 | 79 | 64 | 37 | 28 | 20 | 12 | 8 | [6] | [6] | A-4(0) | SM. |
| 32 | 26 | 21 | 17 | 13 | 8 | 7 | 5 | 4 | 3 | 2 | 1 | [6] | [6] | A-1-a(0) | GW-GM. |
| 98 | 96 | 92 | 88 | 84 | 77 | 71 | 54 | 45 | 32 | 19 | 14 | 30 | 6 | A-4(4) | ML-CL. |
| 88 | 87 | 86 | 85 | 76 | 74 | 71 | 64 | 61 | 57 | 51 | 49 | 94 | 48 | A-7-5(20) | MH. |
| 69 | 68 | 66 | 62 | 57 | 52 | 50 | 43 | 40 | 34 | 28 | 24 | 60 | 30 | A-7-5(16) | MH-CH. |
| 99 | 97 | 95 | 92 | 83 | 75 | 72 | 66 | 64 | 58 | 51 | 46 | 90 | 49 | A-7-5(17) | MH. |
| | | 100 | 96 | 87 | 86 | 85 | 82 | 80 | 74 | 65 | 57 | 104 | 57 | A-7-5(20) | MH. |
| | | | | 100 | 99 | 97 | 88 | 81 | 56 | 32 | 21 | 28 | 6 | A-4(8) | ML-CL. |
| | | | | 100 | 99 | 98 | 95 | 93 | 84 | 73 | 63 | 68 | 28 | A-7-5(19) | MH. |
| | | | | 100 | 99 | 98 | 97 | 95 | 87 | 72 | 60 | 64 | 30 | A-7-5(20) | MH. |

[3] Based on the total amount of material. Laboratory test data corrected for the amount discarded in field sampling.

[4] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145-49.

[5] Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Vol. 1, Waterways Experiment Station, Corps of Engineers, March 1953 (*17*). SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are GM-GC, ML-CL, and MH-CH.

[6] Nonplastic.

Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How Soils Are Mapped and Classified," not all mapping units are members of a soil series. Rock land, for example, does not belong to a soil series but, nevertheless, is listed in alphabetical order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of most mapping units is the capability unit in which the mapping unit has been placed. In a number of soil complexes and groups of undifferentiated soils, however, the individual soils that make up the complex or the undifferentiated group have been placed in different capability units. For these mapping units, two or more capability units are listed. The page on which each capability unit is described can be readily found by referring to the "Guide to Mapping Units" at the back of the report.

Soil scientists, engineers, students, and others who want further information about the soil series should turn to the section "Formation, Classification, and Morphology of Soils." Many terms used in the soil descriptions and in other sections of the report are defined in the Glossary.

TABLE 3.—*Estimated physical properties and qualities of untested*

| Soil series | Drainage | Depth from surface | Horizon | Classification | | Grain size | |
|---|---|---|---|---|---|---|---|
| | | | | Unified | AASHO | Percentage passing sieve— No. 200 (0.074 mm.) | No. 4 (4.7 mm.) |
| | | *Inches* | | | | | |
| Agency (AaE, AaG) | Good. | 0–11 | A1, A3 | SM | A–1 or A–2 | 15 | 60 |
| | | 11–22 | B1t, B2t | SC | A–4 | 40 | 65 |
| | | 22–36 | C1ca | SM–SC or GM–GC. | A–2 | 25 | 60 |
| Bakeoven (BaD, BbD; and in complexes DuB and DvB). | Good. | 0–4 | A1 | GM–GC | A–2 | 25 | 35 |
| | | 4–12 | B1t, B2t | GM–GC | A–2 | 30 | 40 |
| Boyce (Br, Bs, Bw, By) | Poor or very poor. | 0–3 | A11 | OH | A–7 | 85 | 100 |
| | | 3–24 | A12g, A13g, AC1g, AC2. | MH | A–7 | 80 | 100 |
| | | 24–31 | C | CL | A–6 | 55 | 100 |
| Courtrock (CkA, CkB, CkC, CmA, CmB, CmC, CoB, CoD). | Good. | 0–16 | Ap, B1 | SM | A–4 | 40 | 98 |
| | | 16–30 | B21, B22 | SM–SC | A–4 | 40 | 85 |
| | | 30–60 | C1ca, C2ca, C3ca. | SM | A–1 | 25 | 80 |
| Crooked (CrA, CsA, CtA, CtB; and in complex Sm). | Imperfect. | 0–13 | Ap, AC | SM | A–4 | 55 | 100 |
| | | 13–33 | Cm, C2m | (2) | (2) | (2) | (2) |
| | | 33–60 | C3 | ML–CL | A–4 | 60 | 100 |
| Elmore (EmE) | Good. | 0–14 | A1, A3, B1t | ML | A–2 | 35 | 50 |
| | | 14–35 | B21t, B22t | ML | A–2 | 25 | 30 |
| | | 35–50 | B23t | GP–GC | A–2 | 7 | 10 |
| Forester (Fo, Fr) | Imperfect. | 0–12 | Ap, AC | SM | A–4 | 45 | 100 |
| | | 12–27 | C1, C2 | SM | A–4 | 40 | 100 |
| | | 27–48 | IIC3 | ML–CL | A–4 | 55 | 100 |
| Gem (GaD, GbE; also in complexes GcE and GgE). | Good. | 0–13 | A1, A3, B1t | ML | A–2 | 35 | 55 |
| | | 13–28 | B2t, B3tca | GM | A–2 | 30 | 55 |
| Lookout (LoA, LoB, LsB, LsD, LvE). | Good. | 0–8 | A1 | ML | A–4 | 45 | 70 |
| | | 8–20 | B1t, B2t, B3tca. | MH | A–7 | 50 | 70 |
| | | 20–30 | Csim | (3) | (3) | (3) | (3) |
| Metolius (MaA, MoA, MoB, MoC, MsA, MsB, MsC, MsD). | Good or somewhat excessive. | 0–18 | Ap, C1 | SM | A–2 | 35 | 95 |
| | | 18–60 | C2, C3 | SM | A–2 | 35 | 95 |
| Ochoco (OcA, OcB, OdB, OgB, OhA, OhB, OmA, OmB, OmC, OoA; and in soil groups AoA, AoB, AoC, AoD, ArA, ArD, ArE, AsB). | Good. | 0–21 | Ap, A3, B1t | SM | A–4 | 40 | 95 |
| | | 21–36 | B2t, B3 | SC | A–4 | 40 | 90 |
| | | 36–46 | C1simca | (2) | (2) | (2) | (2) |

*soils in the Area as determined by interpreting soil survey data*

| Liquid limit | Plasticity index | Permeability | Structure | pH | Alkali | Shrink-swell potential | Other characteristics of series |
|---|---|---|---|---|---|---|---|
| | | In. per hr. | | | | | |
| (1) | (1) | 5.0–10.0 | Weak, very fine, granular | 6.8–7.0 | None | Low. | Very stony, 25 to 50 percent of stones larger than 3 inches; steep slopes. |
| 30 | 10 | 0.2–0.8 | Moderate, medium and fine, blocky. | 7.3–8.0 | None | Moderate. | |
| 25 | 5 | 0.2–10.0 | Massive | 8.0–8.4 | None | Low. | |
| 30 | 5 | 0.8–2.5 | Moderate, thin, platy and weak, fine, granular. | 6.6–6.8 | None | Moderate. | Very stony, 40 to 60 percent of stones larger than 3 inches. |
| 41 | 12 | 0.2–0.8 | Moderate, fine and medium, blocky. | 6.8–7.0 | None | Moderate to high. | |
| 70 | 30 | 0.8–2.5 | Moderate, medium, granular | 7.5–8.4 | Slight to strong. | Moderate. | Fluctuating high water table. |
| 65 | 30 | 0.2–0.8 | Moderate, medium and fine, blocky. | 8.0–8.4 | Slight to strong. | Moderate. | |
| 35 | 12 | 0.2–10.0 | Massive | 7.6–8.4 | Slight to strong. | Moderate. | |
| (1) | (1) | 5.0–10.0 | Weak, fine, granular | 6.8–7.0 | None | Low. | Below depth of 16 inches, 10 to 15 percent of cobbles larger than 3 inches; lime below depth of about 30 inches. |
| 32 | 5 | 0.8–2.5 | Weak, medium, subangular blocky and blocky. | 7.0–7.8 | None | Low. | |
| 28 | 2 | 5.0–10.0 | Massive | 7.9–8.4 | None | Low. | |
| (1) | (1) | 0.8–2.5 | Weak, fine, granular | 8.5–9.8 | Moderate to strong. | Low. | Fluctuating high water table. |
| (2) | (2) | <0.2 | (2) | 8.0–10.0 | Moderate to strong. | None. | |
| 20 | 5 | 0.8–2.5 | Massive, stratified | 8.5–9.6 | Moderate to strong. | Low. | |
| 30 | 5 | 0.8–2.5 | Weak, platy and weak, fine, granular. | 6.3–7.0 | None | Low. | Very stony, 35 to 50 percent of stones larger than 3 inches. |
| 65 | 35 | 0.2–0.8 | Moderate, medium, prismatic and medium and fine, blocky. | 7.0–7.3 | None | Low. | |
| 60 | 30 | 0.2–0.8 | Weak, medium and fine, blocky | 7.4–7.6 | None | Low. | |
| (1) | (1) | 5.0–10.0 | Weak, platy to single grain | 9.0–9.6 | Slight to strong. | Low. | |
| (1) | (1) | 5.0–10.0 | Massive | 8.6–9.6 | Slight to strong. | Low. | |
| 30 | 5 | 0.8–2.5 | Massive to weak, platy | 8.5–9.0 | Slight to strong. | Low. | |
| 35 | 8 | 0.8–2.5 | Moderate, granular and blocky | 6.5–7.0 | None | Low. | Stony or very stony, about 35 percent of stones larger than 3 inches. |
| 75 | 38 | 0.2–0.8 | Moderate, prismatic and strong, fine, blocky. | 7.0–8.2 | None | Moderate. | |
| 35 | 10 | 0.8–2.5 | Moderate, platy and granular | 6.7–6.8 | None | Low. | Nonstony to very stony, 15 to 25 percent of cobbles larger than 3 inches. |
| 78 | 40 | 0.05–0.2 | Strong, prismatic and blocky | 6.8–8.0 | None | High. | |
| (3) | (3) | 0.05 | (3) | 8.3 | None | None. | |
| (1) | (1) | 5.0–10.0 | Weak, platy, massive, granular or single grain. | 6.8–7.3 | None | Low. | |
| (1) | (1) | 5.0–10.0 | Massive to single grain | 7.3–8.2 | None | Low. | |
| (1) | (1) | 0.8–10.0 | Weak, granular and subangular blocky. | 6.8–7.3 | None | Low. | |
| 30 | 10 | 0.2–2.5 | Weak, prismatic and moderate, fine, subangular blocky. | 7.2–7.8 | None | Moderate. | |
| (2) | (2) | <2.5 | (2) | 7.8–8.4 | None | None. | |

TABLE 3.—*Estimated physical properties and qualities of untested soils*

| Soil series | Drainage | Depth from surface | Horizon | Classification | | Grain size | |
|---|---|---|---|---|---|---|---|
| | | | | Unified | AASHO | Percentage passing sieve— No. 200 (0.074 mm.) | Percentage passing sieve— No. 4 (4.7 mm.) |
| | | *Inches* | | | | | |
| Ontko (Op, Ot) | Poor or very poor. | 0–7 | Ap | MH | A–7 | 85 | 100 |
| | | 7–22 | A1, AC | MH | A–7 | 80 | 100 |
| | | 22–43+ | C1, C2 | ML–CL | A–4 | 55 | 90 |
| Polly (PaB, PaC, PgB, PgC, PhB, PkB, PkC, PlD). | Good. | 0–6 | A1 | ML–CL | A–4 | 50 | 80 |
| | | 6–18 | B1t, B2t | MH | A–7 | 60 | 80 |
| | | 18–72 | B3, C1ca, C2 | CH | A–7 | 60 | 85 |
| Powder (Pm, Pn, Po, Pr, Ps, Pt, Pu). | Good or moderately good. | 0–13 | Ap, AC | ML–CL | A–4 | 70 | 100 |
| | | 13–48 | C1, C2, C3, C4 | ML–CL | A–4 | 70 | 100 |
| | | 48–80 | C5 | ML–CL | A–4 | 60 | 100 |
| Prineville (PvA, PvB, PvC, PwA, PwB, PwC, PxB, PxD). | Good. | 0–20 | Ap, A3, B2 | SM | A–4 | 40 | 95 |
| | | 20–47 | C1m, C2m | SM | A–4 | 45 | 95 |
| | | 47–60 | C3 | SM | A–2 | 30 | 85 |
| Redmond (RdA, RmA, RmB, RnB, RoB, RrC). | Good. | 0–15 | A1, A3, B1t | SM | A–4 | 40 | 95 |
| | | 15–34 | B2t, C1, C2ca | CL–ML | A–4 | 55 | 95 |
| Salisbury (SaB, SbB, SbD) | Good. | 0–8 | A1, A3 | SM | A–4 | 36 | 60 |
| | | 8–21 | B1t, B2t | MH | A–7 | 45 | 65 |
| | | 21–38 | C1m, C2m | (3) | (3) | (3) | (3) |
| Slayton (ShD, ShE, SkD; also in complexes SfD and SfE). | Good. | 0–8 | A1, AC | SM | A–2 | 25 | 65 |
| | | 8–14 | C | SM–SC | A–2 | 26 | 60 |
| Stearns (Sl; and in complex Sm). | Imperfect. | 0–5 | A21, A22 | ML–MH | A–7 | 85 | 100 |
| | | 5–13 | B2t | MH | A–7 | 92 | 100 |
| | | 13–36 | C1ca, C2ca | MH | A–7 | 80 | 100 |
| Steiger (Ss) | Good. | 0–14 | Ap, AC | SM | A–4 | 45 | 100 |
| | | 14–28 | C1, C2 | SM–SC | A–4 | 48 | 100 |
| | | 28–69 | C3 | SM | A–4 | 40 | 100 |
| Veazie (Va, Vb, Vg; and in complex Vr). | Good or somewhat excessive. | 0–16 | A1, AC | ML–CL | A–4 | 55 | 95 |
| | | 16–24 | C1 | ML–CL | A–4 | 50 | 90 |
| | | 24+ | IIC2 | GM | A–1 | 10 | 40 |

[1] NP=nonplastic.

[2] Weakly to strongly cemented hardpan.

*in the Area as determined by interpreting soil survey data*—Continued

| Liquid limit | Plasticity index | Permeability | Structure | pH | Alkali | Shrink-swell potential | Other characteristics of series |
|---|---|---|---|---|---|---|---|
| | | *In. per hr.* | | | | | |
| 65 | 30 | 0. 2–2. 5 | Moderate, fine, granular | 6. 6–7. 0 | None | Moderate to high. | |
| 55 | 25 | 0. 05–0. 8 | Weak or moderate, fine, subangular blocky. | 6. 7–7. 2 | None | Moderate to high. | |
| 25 | 5 | 0. 2–5. 0 | Massive | 6. 2–7. 6 | None | Low to moderate. | |
| 30 | 5 | 0. 8–2. 0 | Moderate, fine, granular | 6. 7–7. 0 | None | Low. | 0 to 35 percent stones and gravel in upper 2 feet. |
| 80 | 40 | 0. 2–0. 8 | Weak or moderate, prismatic and moderate or strong, fine, blocky. | 6. 8–7. 8 | None | Moderate to high. | |
| 65 | 35 | 0. 2–2. 5 | Moderate, blocky to massive | 7. 6–8. 4 | None | Low to moderate. | |
| 30 | 5 | 0. 8–10. 0 | Weak, granular | 8. 0–8. 3 | None | Low. | |
| 30 | 5 | 0. 8–5. 0 | Weak, subangular blocky to massive. | 8. 0–8. 3 | None | Low. | |
| 25 | 4 | 0. 8–10. 0 | Massive | 8. 2 | None | Low. | |
| (1) | (1) | 2. 5–10. 0 | Weak, fine, granular to weak, subangular blocky. | 6. 8–8. 2 | None | Low. | |
| (1) | (1) | 0. 8–2. 5 | Platy, weakly to strongly cemented hardpan lenses. | 8. 2–9. 2 | None | Low. | |
| (1) | (1) | >10. 0 | Massive | 8. 3–9. 0 | None | Low. | |
| (1) | (1) | 0. 8–10. 0 | Weak, fine, granular | 6. 7–7. 0 | Normally none. | Low. | |
| 30 | 7 | 0. 8–2. 5 | Weak, medium and fine, blocky to massive. | 7. 2–8. 2 | Normally none. | Low to moderate. | |
| 35 | 7 | 0. 8–2. 5 | Moderate, granular and subangular blocky. | 6. 6–7. 0 | None | Low. | 30 percent of cobbles are larger than 3 inches. |
| 80 | 38 | 0. 05–0. 2 | Prismatic and strong, fine, blocky. | 6. 7–7. 5 | None | High. | |
| (3) | (3) | <0. 2 | (3) | 7. 0–8. 4 | None | None. | |
| (1) | (1) | 5. 0–10. 0 | Weak, fine, granular and subangular blocky. | 6. 6–6. 8 | None | Low. | 20 to 50 percent of channery fragments larger than 3 inches. |
| 20 | 5 | 5. 0–10. 0 | Weak, subangular blocky | 7. 0–7. 2 | None | Low. | |
| 50 | 20 | 0. 8–2. 5 | Moderate, platy | 6. 8–9. 0 | Moderate to strong. | Low. | |
| 65 | 30 | 0. 05–0. 2 | Moderate to strong, prismatic and blocky. | 9. 0–10. 0 | Moderate to strong. | Moderate. | |
| 55 | 20 | 0. 05–0. 8 | Weakly lime-cemented pan | 9. 2–10. 0 | Moderate to strong. | Low. | |
| 25 | 2 | 0. 8–10. 0 | Weak, fine, granular | 6. 6–6. 8 | None | Low. | |
| 28 | 4 | 5. 0–10. 0 | Weak, subangular blocky | 6. 9–7. 6 | None | Low. | |
| (1) | (1) | 2. 5–10. 0 | Massive | 7. 5 | None | Low. | |
| 30 | 5 | 0. 8–2. 5 | Weak, granular and subangular blocky. | 6. 6–7. 0 | None | Low. | 35 percent of pebbles larger than 3 inches. |
| 30 | 5 | 0. 8–2. 5 | Massive, stratified | 6. 6–7. 0 | None | Low. | |
| (1) | (1) | >10. 0 | Massive, stratified | 6. 6–7. 0 | None | Low. | |

[3] Strongly cemented hardpan.

771-427—66——3

TABLE 4.—*Approximate acreage and proportionate extent of the soils*

| Map symbol | Soil | Area | Extent | Map symbol | Soil | Area | Extent |
|---|---|---|---|---|---|---|---|
| | | *Acres* | *Percent* | | | *Acres* | *Percent* |
| AaE | Agency very stony sandy loam, 6 to 40 percent slopes | 4, 898 | 2. 9 | DdA | Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes | 471 | 0. 3 |
| AaG | Agency very stony sandy loam, 40 to 70 percent slopes | 648 | . 4 | DdB | Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes | 340 | . 2 |
| AdB | Ayres sandy loam, 2 to 6 percent slopes | 1, 608 | 1. 0 | DmB | Deschutes stony loamy sand, 0 to 6 percent slopes | 1, 164 | . 7 |
| AdC | Ayres sandy loam, 6 to 12 percent slopes | 224 | . 1 | DnA | Deschutes sandy loam, 0 to 2 percent slopes | 5, 923 | 3. 5 |
| AgB | Ayres gravelly sandy loam, 2 to 6 percent slopes | 2, 678 | 1. 6 | DnB | Deschutes sandy loam, 2 to 6 percent slopes | 4, 693 | 2. 8 |
| AgC | Ayres gravelly sandy loam, 6 to 12 percent slopes | 726 | . 4 | DnC | Deschutes sandy loam, 6 to 12 percent slopes | 426 | . 3 |
| AmB | Ayres stony sandy loam, 0 to 6 percent slopes | 2, 483 | 1. 5 | DoA | Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes | 3, 362 | 2. 0 |
| AmD | Ayres stony sandy loam, 6 to 20 percent slopes | 1, 740 | 1. 0 | DoB | Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes | 1, 421 | . 8 |
| AoA | Ayres and Ochoco sandy loams, 0 to 2 percent slopes | 3, 886 | 2. 3 | DoC | Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes | 174 | . 1 |
| AoB | Ayres and Ochoco sandy loams, 2 to 6 percent slopes | 1, 081 | . 6 | DpA | Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes | 199 | . 1 |
| AoC | Ayres and Ochoco sandy loams, 6 to 12 percent slopes | 385 | . 2 | DrA | Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes | 295 | . 2 |
| AoD | Ayres and Ochoco sandy loams, 12 to 20 percent slopes | 180 | . 1 | DrB | Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes | 442 | . 3 |
| ArA | Ayres and Ochoco gravelly sandy loams, 0 to 2 percent slopes | 1, 555 | . 9 | DsA | Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes | 419 | . 2 |
| ArD | Ayres and Ochoco gravelly sandy loams, 6 to 20 percent slopes | 1, 102 | . 7 | DsB | Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes | 279 | . 2 |
| ArE | Ayres and Ochoco gravelly sandy loams, 20 to 40 percent slopes | 371 | . 2 | DtA | Deschutes stony sandy loam, 0 to 2 percent slopes | 2, 194 | 1. 3 |
| AsB | Ayres and Ochoco stony sandy loams, 0 to 6 percent slopes | 3, 198 | 1. 9 | DtB | Deschutes stony sandy loam, 2 to 6 percent slopes | 5, 002 | 3. 0 |
| BaD | Bakeoven very stony loam, 0 to 20 percent slopes | 7, 402 | 4. 4 | DtD | Deschutes stony sandy loam, 6 to 20 percent slopes | 434 | . 3 |
| BbD | Bakeoven very stony sandy loam, 0 to 20 percent slopes | 7, 821 | 4. 6 | DuB | Deschutes-Bakeoven very stony sandy loams, 0 to 6 percent slopes | 153 | (1) |
| Bp | Borrow pits | 98 | (1) | DvB | Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes | 1, 722 | 1. 0 |
| Br | Boyce loam, light-colored variant | 570 | . 3 | EmE | Elmore very stony loam, 6 to 40 percent slopes | 1, 470 | . 9 |
| Bs | Boyce silt loam | 1, 341 | . 8 | Fo | Forester loamy sand | 208 | . 1 |
| Bw | Boyce silt loam, ponded | 357 | . 2 | Fr | Forester sandy loam | 434 | . 3 |
| By | Boyce silty clay loam | 820 | . 5 | GaD | Gem stony loam, 6 to 20 percent slopes | 287 | . 2 |
| CkA | Courtrock sandy loam, 0 to 2 percent slopes | 327 | . 2 | GbE | Gem very stony loam, 6 to 40 percent slopes | 2, 508 | 1. 5 |
| CkB | Courtrock sandy loam, 2 to 6 percent slopes | 443 | . 3 | GcE | Gem-Day stony clay loams, 12 to 40 percent slopes | 967 | . 6 |
| CkC | Courtrock sandy loam, 6 to 12 percent slopes | 372 | . 2 | GgE | Gem-Searles stony loams, 6 to 40 percent slopes | 2, 515 | 1. 5 |
| CmA | Courtrock gravelly sandy loam, 0 to 2 percent slopes | 423 | . 3 | LaB | Lamonta loam, 0 to 6 percent slopes | 80 | (1) |
| CmB | Courtrock gravelly sandy loam, 2 to 6 percent slopes | 257 | . 2 | LgC | Lamonta gravelly loam, 6 to 12 percent slopes | 189 | . 1 |
| CmC | Courtrock gravelly sandy loam, 6 to 12 percent slopes | 309 | . 2 | LmD | Lamonta stony loam, 6 to 20 percent slopes | 181 | . 1 |
| CoB | Courtrock stony sandy loam, 2 to 6 percent slopes | 183 | . 1 | LoA | Lookout loam, 0 to 2 percent slopes | 341 | . 2 |
| CoD | Courtrock stony sandy loam, 6 to 20 percent slopes | 345 | . 2 | LoB | Lookout loam, 2 to 6 percent slopes | 308 | . 2 |
| CrA | Crooked loam, 0 to 2 percent slopes | 584 | . 3 | LsB | Lookout stony loam, 0 to 6 percent slopes | 420 | . 2 |
| CsA | Crooked loamy sand, 0 to 2 percent slopes | 280 | . 2 | LsD | Lookout stony loam, 6 to 20 percent slopes | 578 | . 3 |
| CtA | Crooked sandy loam, 0 to 2 percent slopes | 1, 361 | . 8 | LvE | Lookout very stony loam, 0 to 40 percent slopes | 3, 655 | 2. 2 |
| CtB | Crooked sandy loam, 2 to 6 percent slopes | 186 | . 1 | MaA | Metolius loam, 0 to 2 percent slopes | 625 | . 4 |
| DaE | Day clay, 6 to 40 percent slopes | 142 | (1) | | | | |
| DcA | Deschutes loamy sand, 0 to 2 percent slopes | 1, 042 | . 6 | | | | |
| DcB | Deschutes loamy sand, 2 to 6 percent slopes | 1, 533 | . 9 | | | | |
| DcD | Deschutes loamy sand, 6 to 20 percent slopes | 341 | . 2 | | | | |

TABLE 4.—*Approximate acreage and proportionate extent of the soils*—Continued

| Map symbol | Soil | Area | Extent | Map symbol | Soil | Area | Extent |
|---|---|---|---|---|---|---|---|
| | | *Acres* | *Percent* | | | *Acres* | *Percent* |
| MoA | Metolius loamy sand, 0 to 2 percent slopes | 224 | 0.1 | PvC | Prineville sandy loam, 6 to 12 percent slopes | 908 | 0.5 |
| MoB | Metolius loamy sand, 2 to 6 percent slopes | 546 | .3 | PwA | Prineville sandy loam, thick surface, 0 to 2 percent slopes | 257 | .2 |
| MoC | Metolius loamy sand, 6 to 12 percent slopes | 291 | .2 | PwB | Prineville sandy loam, thick surface, 2 to 6 percent slopes | 500 | .3 |
| MsA | Metolius sandy loam, 0 to 2 percent slopes | 1,240 | .7 | PwC | Prineville sandy loam, thick surface, 6 to 12 percent slopes | 255 | .2 |
| MsB | Metolius sandy loam, 2 to 6 percent slopes | 667 | .4 | PxB | Prineville gravelly sandy loam, 2 to 6 percent slopes | 121 | (1) |
| MsC | Metolius sandy loam, 6 to 12 percent slopes | 107 | (1) | PxD | Prineville gravelly sandy loam, 6 to 20 percent slopes | 307 | .2 |
| MsD | Metolius sandy loam, 12 to 20 percent slopes | 311 | .2 | RdA | Redmond loam, 0 to 2 percent slopes | 3,957 | 2.4 |
| OcA | Ochoco loam, 0 to 2 percent slopes | 329 | .2 | RmA | Redmond sandy loam, 0 to 2 percent slopes | 5,500 | 3.3 |
| OcB | Ochoco loam, 2 to 6 percent slopes | 141 | (1) | RmB | Redmond sandy loam, 2 to 6 percent slopes | 628 | .4 |
| OdB | Ochoco loamy sand, 2 to 6 percent slopes | 239 | .1 | RnB | Redmond stony loam, 0 to 6 percent slopes | 450 | .3 |
| OgB | Ochoco gravelly loam, 2 to 6 percent slopes | 249 | .1 | RoB | Redmond stony sandy loam, 0 to 6 percent slopes | 2,870 | 1.7 |
| OhA | Ochoco gravelly sandy loam, 0 to 2 percent slopes | 416 | .2 | RrC | Redmond very stony sandy loam, 6 to 12 percent slopes | 678 | .4 |
| OhB | Ochoco gravelly sandy loam, 2 to 6 percent slopes | 900 | .5 | Rv | Riverwash | 988 | .6 |
| OmA | Ochoco sandy loam, 0 to 2 percent slopes | 3,315 | 2.0 | Rx | Rock land | 12,775 | 7.6 |
| | | | | Ry | Rock outcrop | 1,285 | .8 |
| OmB | Ochoco sandy loam, 2 to 6 percent slopes | 1,328 | .8 | SaB | Salisbury loam, 0 to 6 percent slopes | 155 | (1) |
| OmC | Ochoco sandy loam, 6 to 12 percent slopes | 214 | .1 | SbB | Salisbury very stony loam, 0 to 6 percent slopes | 1,109 | .7 |
| OoA | Ochoco sandy loam, seeped, 0 to 2 percent slopes | 116 | (1) | SbD | Salisbury very stony loam, 6 to 20 percent slopes | 728 | .4 |
| Op | Ontko clay loam, ponded | 235 | .1 | ScD | Searles stony loam, 2 to 20 percent slopes | 1,394 | .8 |
| Ot | Ontko clay loam and clay | 627 | .4 | ScE | Searles stony loam, 20 to 40 percent slopes | 3,390 | 2.0 |
| PaB | Polly loam, 0 to 6 percent slopes | 584 | .3 | | | | |
| PaC | Polly loam, 6 to 12 percent slopes | 556 | .3 | SdD | Searles stony clay loam, 6 to 20 percent slopes | 166 | (1) |
| PgB | Polly gravelly loam, 0 to 6 percent slopes | 329 | .2 | SdE3 | Searles stony clay loam, 20 to 40 percent slopes, severely eroded | 138 | (1) |
| PgC | Polly gravelly loam, 6 to 12 percent slopes | 503 | .3 | SeD | Searles stony sandy loam, 6 to 20 percent slopes | 766 | .5 |
| PhB | Polly sandy loam, 2 to 6 percent slopes | 144 | (1) | SeE | Searles stony sandy loam, 20 to 40 percent slopes | 801 | .5 |
| PkB | Polly sandy loam, thick surface, 2 to 6 percent slopes | 171 | .1 | SfD | Searles-Slayton complex, 2 to 20 percent slopes | 428 | .3 |
| PkC | Polly sandy loam, thick surface, 6 to 12 percent slopes | 245 | .1 | SfE | Searles-Slayton complex, 20 to 40 percent slopes | 519 | .3 |
| PlD | Polly stony loam, 6 to 20 percent slopes | 399 | .2 | ShD | Slayton channery sandy loam, 2 to 20 percent slopes | 481 | .3 |
| Pm | Powder loam | 1,293 | .8 | | | | |
| Pn | Powder fine sandy loam, coarse variant | 330 | .2 | ShE | Slayton channery sandy loam, 20 to 40 percent slopes | 415 | .2 |
| Po | Powder fine sandy loam, over gravel, coarse variant | 152 | (1) | SkD | Slayton sandy loam, 2 to 20 percent slopes | 1,241 | .7 |
| | | | | Sl | Stearns silt loam | 1,200 | .7 |
| Pr | Powder gravelly loam | 194 | .1 | Sm | Stearns-Crooked complex | 296 | .2 |
| Ps | Powder sandy loam | 705 | .4 | Ss | Steiger sandy loam | 232 | .1 |
| Pt | Powder silt loam | 2,167 | 1.3 | Sw | Swartz silt loam | 478 | .3 |
| Pu | Powder silt loam, over gravel | 420 | .2 | Va | Veazie loam | 487 | .3 |
| PvA | Prineville sandy loam, 0 to 2 percent slopes | 2,409 | 1.4 | Vb | Veazie loam, shallow | 212 | .1 |
| | | | | Vg | Veazie gravelly loam | 620 | .4 |
| PvB | Prineville sandy loam, 2 to 6 percent slopes | 2,110 | 1.3 | Vr | Veazie-Riverwash complex | 407 | .2 |
| | | | | | Total | 168,528 | 100.0 |

[1] Less than 0.1 percent.

## Agency Series

Soils of the Agency series are rolling to very steep, light colored, very stony, and well drained. These soils occur between the bottom land of the Crooked River and the basalt rimrock of the upland plateau. They developed from mixed volcanic and water-deposited materials that were derived from pumice, sandstone, gravel, and basalt. The plant cover consists mainly of sagebrush, bluebunch wheatgrass, Sandberg bluegrass, and scattered juniper.

These soils have surface and subsurface layers of light brownish-gray, neutral very stony sandy loam. The surface layer combined with the subsurface layer is about 11 inches thick. The subsoil, to a depth of about 22 inches, is brown very stony clay loam. Depth to bedrock ranges from 18 to 40 inches and varies widely within short distances.

Agency soils are used entirely for grazing.

**Agency very stony sandy loam, 6 to 40 percent slopes** (AaE).—This sloping to steep soil occurs mainly in a nearly continuous area between the bottom land of the Crooked River and the basalt rimrock of the upland plateau. The area is 1/16 to 1/4 mile wide and more than 10 miles long.

Representative profile:

0 to 11 inches, light brownish-gray very stony sandy loam; neutral.
11 to 22 inches, brown very stony clay loam; mildly to moderately alkaline; calcareous in lower part.
22 to 36 inches, light brownish-gray very gravelly and stony sandy loam or sandy clay loam; moderately alkaline; calcareous.
36 inches +, light brownish-gray gravel and stones grading to sandstone or basalt.

This soil is very stony or extremely stony. On Grass and Coyote Buttes, it is underlain by cinders. Included in some areas mapped as this soil are areas of Agency very stony sandy loam, 40 to 70 percent slopes, that make up 10 to 15 percent of the acreage mapped. Also included are small areas of Rock outcrop and Deschutes stony sandy loam, 6 to 20 percent slopes.

Runoff is slow to medium, and water erosion is a moderate hazard. Permeability is moderately slow in the subsoil. Fertility and the moisture-holding capacity are low. Roots penetrate to a moderate depth.

This soil is used for limited grazing in spring and fall. It is not suitable for irrigation. *Capability unit VIIs-1*

**Agency very stony sandy loam, 40 to 70 percent slopes** (AaG).—In many places this very steep soil is shallower and more stony than Agency very stony sandy loam, 6 to 40 percent slopes. On north-facing slopes the surface layer is grayish brown and is covered by a stand of bluebunch wheatgrass that is denser than that on south-facing slopes, where the surface layer is light brownish gray.

Included in some areas mapped as this soil are areas of Agency very stony sandy loam, 6 to 40 percent slopes, and areas of Rock land and Rock outcrop that make up as much as 15 percent of the acreage mapped.

This soil has rapid or very rapid runoff and is highly susceptible to water erosion. It is not suitable for irrigation but is used for limited grazing, mainly by sheep. *Capability unit VIIs-3*

## Ayres Series

The Ayres series consists of light-colored, well-drained soils that are shallow to hardpan. These soils are mainly on alluvial fans at the base of the Powell Buttes, and here they were derived mostly from rhyolitic material washed out from the buttes, though their upper part was influenced by a layer of pumice as much as 12 inches deep in places. In other areas the Ayres soils developed from gravelly material mixed with pumice in the upper layers. The vegetation is mainly bluebunch wheatgrass, Sandberg bluegrass, needlegrasses, sagebrush, and scattered juniper.

The surface layer of Ayres soils is light brownish-gray gravelly sandy loam 4 to 9 inches thick. It has a low organic-matter content and is neutral. The subsoil is pale-brown clay loam that is 5 to 9 inches thick and is gravelly or stony in most places. Underlying the subsoil at a depth of 12 to 20 inches is a very hard, gravelly and cobbly hardpan, 4 to 25 inches thick. The hardpan is cemented with silica.

Ayres soils are used mainly for grazing and for dry-farmed small grain. Some areas are irrigated or are suitable for irrigation.

**Ayres gravelly sandy loam, 2 to 6 percent slopes** (AgB).—This soil is on alluvial fans and commonly occurs in long, narrow areas that extend from the base of the Powell Buttes and parallel the drainageways. Areas near the lower end of fans are almost oblong.

On the upper part of alluvial fans, this soil occurs below stony Ayres soils, and on the lower part it is surrounded by nearly level gravelly Ayres and Ochoco soils.

Representative profile:

0 to 8 inches, light brownish-gray gravelly sandy loam, dark grayish brown when moist; soft or slightly hard; neutral.
8 to 14 inches, brown gravelly clay loam; hard; neutral.
14 to 29 inches, pale-brown, gravelly and cobbly, indurated hardpan.
29 to 50 inches, light brownish-gray very gravelly and cobbly loam or sandy loam; lime in seams.

In a few small areas near the buttes, the surface layer when moist is very dark grayish brown or slightly darker. The depth to hardpan is 12 to 20 inches.

This soil has slow surface runoff. Under irrigation, it is moderately susceptible to erosion. Permeability is moderately slow in the subsoil and is very slow in the hardpan. The moisture-holding capacity and the fertility are low. Root growth is shallow. This soil is difficult to irrigate but is easy to work, though gravel commonly damages machinery.

About half the acreage is above the irrigation canal and is used mainly for grazing. Years ago a few areas were dryfarmed to wheat and then abandoned. These areas have been invaded by cheatgrass, rabbitbrush, and some sagebrush. Under irrigation, this soil is moderately well suited to alfalfa, potatoes, wheat, and barley, though the hardpan limits root growth. The soil is well suited to grasses and to Ladino, alsike, and red clovers for hay and pasture. *Capability unit IIe-5*

**Ayres gravelly sandy loam, 6 to 12 percent slopes** (AgC).—Almost all of this soil is above existing irrigation canals. The soil lies on the east and west sides of the Powell Buttes, just below areas of Searles soils, Elmore very stony loam, 6 to 40 percent slopes, and Ayres stony sandy loam, 6 to 20 percent slopes.

The soil is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes. In several small areas near the Elmore soil, the surface layer is darker than in other areas and, when moist, is very dark grayish brown or slightly darker.

Surface runoff is slow to medium; nevertheless, the erosion hazard is severe where the soil is irrigated. The moisture-holding capacity is low. Because of slope and the gravel content, the soil is difficult to work and to irrigate.

Under irrigation, this soil is poorly suited to potatoes and other row crops. It is moderately well suited to sod and to close-growing crops. *Capability unit IIIe-4*

**Ayres sandy loam, 2 to 6 percent slopes** (AdB).—This soil is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes, but it has few or no pebbles in the surface layer. It occurs on all parts of the Powell Buttes fan, generally at lower elevations than Ayres stony sandy loam, 0 to 6 percent slopes, and Ayres gravelly sandy loam, 2 to 6 percent slopes. Soils adjacent to this soil are Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes, and Ayres and Ochoco sandy loams, 0 to 2 percent slopes.

This soil has low moisture-holding capacity. It is difficult to irrigate but is very easy to work. Erosion is a moderate hazard in irrigated areas.

About half of this soil is above present irrigation canals and is used mainly for grazing. A small acreage is dryfarmed to rye for hay or for grain. Crop suitability is the same as that of Ayres gravelly sandy loam, 2 to 6 percent slopes. *Capability unit IIe-5*

**Ayres sandy loam, 6 to 12 percent slopes** (AdC).—Most of this soil occurs near the base of the Powell Buttes and is above present irrigation canals. In many places it is next to gently sloping and sloping, stony and gravelly Ayres soils.

This soil is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes, but it contains few or no pebbles in the surface layer. In several small areas near Elmore very stony loam, 6 to 40 percent slopes, the surface layer of this soil is darker than typical and, when moist, is very dark grayish brown or slightly darker.

Surface runoff is slow to medium. The moisture-holding capacity is low. Under irrigation, the soil is highly susceptible to erosion and is difficult to irrigate and slightly difficult to work. It is poorly suited to potatoes and other row crops but is moderately well suited to sod and other close-growing crops. *Capability unit IIIe-3*

**Ayres stony sandy loam, 0 to 6 percent slopes** (AmB).—This soil extends over much of the Powell Buttes fan. Above this soil are areas of Ayres stony sandy loam, 6 to 20 percent slopes, Elmore very stony loam, 6 to 40 percent slopes, and Searles soils. Below and adjacent to it are areas of gently sloping Ayres soils and of nearly level, gravelly and nongravelly Ayres and Ochoco soils. The soil has stony surface and subsurface layers, but in other respects it is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes.

This soil has slow or very slow runoff and low moisture-holding capacity. Under irrigation, the soil is slightly to moderately erodible. It is very difficult to irrigate and to work, mainly because of stones.

Little of this soil is irrigated. Potatoes and other row crops are poorly suited to it, and alfalfa and small grain are only moderately well suited. Pasture is the best use. *Capability unit IVs-2*

**Ayres stony sandy loam, 6 to 20 percent slopes** (AmD).—Most of this soil occurs near the base of the Powell Buttes, below areas of Searles soils and above most areas of other Ayres soils. Slopes generally range from 6 to 12 percent but are as much as 20 percent in a few places.

Except for its stony surface and subsurface layers, this soil is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes. In several areas near Elmore very stony loam, 6 to 40 percent slopes, the surface layer of this soil is very dark grayish brown when moist, or slightly darker.

Surface runoff is slow to medium. The moisture-holding capacity is low. In range areas the erosion hazard is moderate, but in irrigated fields it is severe. The soil is difficult to work and to irrigate because of stones and slope.

Under irrigation the soil is best suited to pasture, but only a small acreage is irrigated. *Capability unit VIe-1*

**Ayres and Ochoco sandy loams, 0 to 2 percent slopes** (AoA).—About half the acreage of this undifferentiated group of soils occurs on the outer reaches of the Powell Buttes fan and is below steeper Ayres soils. Most of the rest is east of Huston Lake and is above existing irrigation canals.

This unit consists of Ayres sandy loam, 0 to 2 percent slopes, and a soil that is like Ochoco sandy loam, 0 to 2 percent slopes, but has a hardpan at a depth of 20 to 30 inches. Except for having only a few or no pebbles in the surface layer, the Ayres soil is similar to Ayres gravelly sandy loam, 2 to 6 percent slopes. The depth to hardpan ranges from 12 to 20 inches.

On these soils surface runoff is very slow or slow, and the erosion hazard is only slight. The moisture-holding capacity is low in the Ayres soil and moderate in the Ochoco soil. The soils are easily worked, and the Ochoco soil can be irrigated without difficulty, but irrigation is slightly difficult on the Ayres soils.

Less than half of this unit is used for irrigated crops, and a small acreage is dryfarmed to rye for hay or for grain. Under irrigation, the Ayres soil is moderately well suited to potatoes, wheat, barley, and alfalfa. The Ochoco soil is well suited to potatoes, other row crops, small grain, and alfalfa. Both are good soils for grasses and red, alsike, and Ladino clovers grown for pasture or hay. In the Ayres soil the hardpan limits root growth of alfalfa and other deep-rooted plants. *Ayres soil: capability unit IIs-4; Ochoco soil: capability unit IIs-3*

**Ayres and Ochoco sandy loams, 2 to 6 percent slopes** (AoB).—The soils in this undifferentiated unit are Ayres sandy loam, 2 to 6 percent slopes, and Ochoco sandy loam, 2 to 6 percent slopes. The unit occurs in areas that generally range from 10 to 40 acres in size and commonly are next to areas of Ayres and Ochoco stony sandy loams, 0 to 6 percent slopes, Ayres and Ochoco sandy loams, 0 to 2 percent slopes, and Bakeoven soils.

Most of this unit is above existing irrigation canals and is used as range. Under irrigation, the Ayres soil is moderately well suited to potatoes, wheat, barley, and alfalfa, and it is well suited to grasses and to Ladino, alsike, and red clovers for hay and pasture. The Ochoco soil, under irrigation, is well suited to all crops grown in the survey area. *Ayres soil: capability unit IIe-5; Ochoco soil: capability unit IIe-3*

**Ayres and Ochoco sandy loams, 6 to 12 percent slopes** (AoC).—This undifferentiated unit covers only a small acreage in the survey area. It occurs in areas of 5 to 30 acres that are generally on short slopes just above drainageways. Ayres sandy loam, 6 to 12 percent slopes, and Ochoco sandy loam, 6 to 12 percent slopes, are the soils that make up the unit. These soils normally are deeper on the lower part of slopes than they are on the upper part. Included in areas mapped as these soils are a few small areas that have a loam surface layer.

Under irrigation, these soils are poorly suited to potatoes and other row crops, but they are moderately well suited to all other crops grown in the Area. *Capability unit IIIe–3*

**Ayres and Ochoco sandy loams, 12 to 20 percent slopes** (AoD).—This undifferentiated unit consists of Ayres sandy loam on 12 to 20 percent slopes, and Ochoco sandy loam on 12 to 20 percent slopes. It commonly occurs in long, narrow areas of 10 to 25 acres. These areas generally are 100 to 300 feet wide and 1,000 to 3,000 feet long.

The soils of this unit are highly susceptible to water erosion, though runoff is only medium. Wind erosion is a moderate hazard. The moisture-holding capacity is low in the Ayres soil and moderate in the Ochoco soil. Fertility in the Ayres soil is low, but in the Ochoco soil it is moderate. The soils are very difficult to irrigate and difficult to work.

Under irrigation, these soils are poorly suited to alfalfa and to potatoes and other row crops. They are best suited to pasture plants. *Capability unit IVe–1*

**Ayres and Ochoco gravelly sandy loams, 0 to 2 percent slopes** (ArA).—In this undifferentiated unit are Ayres gravelly sandy loam on 0 to 2 percent slopes, and Ochoco gravelly sandy loam on 0 to 2 percent slopes. These soils are mainly on the lower part of the Powell Buttes fan, below areas of steeper Ayres soils. Included in areas mapped as these soils are areas where the gravelly surface layer is fine sandy loam or loam.

Surface runoff is very slow on these soils and causes only a slight hazard of erosion. The moisture-holding capacity of the Ayres soil is low; that of the Ochoco soil is moderate. Fertility is low in the Ayres soil and is moderate in the Ochoco soil. These soils are slightly difficult to irrigate but are easy to work. Gravel, however, is likely to damage equipment, especially potato diggers.

Most of this unit is in irrigated crops. The soils are suited to the same crops as Ayres gravelly sandy loam, 2 to 6 percent slopes. *Ayres soil: capability unit IIs–4; Ochoco soil: capability unit IIs–3*

**Ayres and Ochoco gravelly sandy loams, 6 to 20 percent slopes** (ArD).—This undifferentiated unit occurs on terrace escarpments north of Prineville, along the Crooked River, and in the Lone Pine area. In most places the soils are on slopes only 150 to 400 feet long, and on the terraces above them are nearly level or gently sloping Ochoco soils. The unit consists of Ayres gravelly sandy loam on 6 to 12 and on 12 to 20 percent slopes, and Ochoco gravelly sandy loam on 6 to 12 and on 12 to 20 percent slopes. In about one-fourth of the acreage mapped as these soils, the surface layer is gravelly loam.

The soils of this unit have slow to medium runoff, but under irrigation, they are highly susceptible to erosion. They are difficult to irrigate and very difficult to work. The moisture-holding capacity is moderate. Little of the unit is cultivated. *Ayres soils: capability units IIIe–4 (6 to 12 percent slopes) and IVe–1 (12 to 20 percent slopes); Ochoco soils: capability units IIIe–3 (6 to 12 percent slopes) and IVe–1 (12 to 20 percent slopes)*

**Ayres and Ochoco gravelly sandy loams, 20 to 40 percent slopes** (ArE).—The soils in this undifferentiated unit are Ayres gravelly sandy loam, 20 to 40 percent slopes, and Ochoco gravelly sandy loam, 20 to 40 percent slopes. These soils are on the breaks, or bluffs, between the bottom lands and the terraces. In most places slopes are only 150 to 400 feet long.

In dryland areas these soils have medium to rapid surface runoff but are only slightly or moderately susceptible to erosion. Their moisture-holding capacity is low to medium. The soils are not suitable for irrigation or for dryfarming. They are best used as range. *Capability unit VIe–1*

**Ayres and Ochoco stony sandy loams, 0 to 6 percent slopes** (AsB).—This undifferentiated unit occurs in areas that range from 10 acres to several hundred acres in size and, in many places, adjoin the Bakeoven soils and other units of Ayres and Ochoco soils. The soils that make up this unit are Ayres stony sandy loam, 0 to 6 percent slopes, and Ochoco stony sandy loam, 0 to 6 percent slopes. In areas mapped as these soils, the surface layer is stony sandy loam in about two-thirds of the acreage, stony loam in less than 5 percent, and stony fine sandy loam in the rest.

Under irrigation, these soils are slightly or moderately susceptible to erosion. Because they are stony, they are slightly difficult or difficult to irrigate and are very difficult to work. Their moisture-holding capacity is low to moderate.

Nearly all the acreage of this unit is above existing canals. If water is made available, the soils are best suited to irrigated pasture. They are poorly suited to potatoes and other row crops. *Capability unit IVs–2*

## Bakeoven Series

The Bakeoven series consists of light-colored, very shallow or shallow, well-drained soils that occur on the gently sloping upland plateau in the western part of the survey area. These soils developed on basalt bedrock under a cover of bunchgrasses, sagebrush, and juniper. They are very stony and commonly are called scabland soils.

The Bakeoven soils have a surface layer of grayish-brown, neutral very stony loam or very stony sandy loam 2 to 8 inches thick. The subsoil of brown to pale-brown very stony clay loam to very stony heavy loam is neutral and 4 to 10 inches thick. Basalt bedrock is within 6 to 12 inches of the surface.

These soils are mainly in range, but some areas are irrigated by wild flooding and used for pasture.

**Bakeoven very stony loam, 0 to 20 percent slopes** (BaD).—This soil commonly occurs on ridges above the Redmond and Deschutes soils. Slopes are mainly less than 6 percent.

Representative profile:

0 to 4 inches, grayish-brown very stony loam; soft; neutral.
4 to 11 inches, brown or pale-brown very stony heavy loam or very stony clay loam; slightly hard; neutral.
11 inches +, dark-colored vesicular basalt, commonly lime coated.

The surface layer is 2 to 5 inches thick. The depth to bedrock commonly is 6 to 12 inches but is as much as 18 inches in places. Included in a few areas mapped as this soil are small areas of stony Deschutes soils and of stony Redmond soils.

Surface runoff is very slow to medium. The moisture-holding capacity is very low, and permeability is moderately slow in the subsoil. The soil is very low in fertility and has a shallow or very shallow root zone. In range areas the erosion hazard is slight, but in irrigated areas it is moderate. Irrigating this soil is very difficult, and large stones make cultivation impractical.

This soil is used chiefly for range, but in the community of Powell Butte, the nearly level and gently sloping areas are irrigated by wild flooding and used for pasture (fig. 8). *Capability unit VIIs-2*

**Bakeoven very stony sandy loam, 0 to 20 percent slopes** (BbD).—This soil is similar to Bakeoven very stony loam, 0 to 20 percent slopes, but its surface layer is 4 to 8 inches of sandy loam that formed from wind-blown pumice. The subsoil is 4 to 10 inches thick. Depth to bedrock generally ranges from 8 to 12 inches, but in small areas it is as much as 18 inches. In a few areas mapped as this soil the surface layer is loamy sand. *Capability unit VIIs-2*

## Borrow Pits (Bp)

This miscellaneous land type consists of areas from which gravel, sand, and other soil material have been removed for use in building roads and dams and for other purposes. These areas have little or no plant cover. *Capability unit VIIIs-1*

## Boyce Series

The Boyce series consists of dark-colored, poorly drained or very poorly drained soils that occur on bottom land along Ochoco Creek east of Prineville and along the Crooked River northwest of the city. These soils formed in mixed alluvium that was derived mainly from basalt and partly from rhyolitic tuff and rhyolite. The water table was moderately high while the soils were forming, and it fluctuates between the surface and a depth of about 4 feet during most of the year.

The Boyce soils are nearly level but are cut by old stream channels in some areas. In spring they are frequently flooded and covered with fresh layers of silt. Generally, they were calcareous and contain alkali. The plant cover consists of willows, rushes, sedges, clovers, and annual grasses.

In cultivated areas the Boyce soils have a surface layer of grayish-brown silty clay loam, silt loam, or loam, 6 to 12 inches thick. This layer is mottled with reddish brown or dark olive gray. It is moderately calcareous and moderately alkaline.

The subsoil is 8 to 18 inches of grayish-brown clay loam or silty clay loam that is mottled with colors somewhat like those of the surface layer. Generally, it is calcareous in the upper part and noncalcareous in the lower part. The upper substratum is noncalcareous, gray silt loam, sandy loam, or sandy clay loam. It is 6 to 36 inches thick. The lower substratum occurs at a depth of 30 to 60 inches and consists of stratified gravel and sand.

**Boyce silty clay loam** (By).—This soil is in low, nearly level areas on the flood plain of streams. Although the areas generally are irregular in shape, they tend to be long and narrow and roughly parallel to the streams. They commonly range from 500 to 3,000 feet in length and from 200 to 600 feet in width. The lowest areas are commonly flooded for short periods in spring. In many places only a few feet higher than this soil are areas of Powder silt loam, Boyce silt loam, and Stearns silt loam.

Representative profile:

0 to 10 inches, grayish-brown silty clay loam mottled with reddish brown and dark olive gray; hard; moderately calcareous; moderately alkaline.

10 to 31 inches, grayish-brown, mottled clay loam becoming coarser with depth and changing to gray; hard; calcareous in the upper part; moderately or mildly alkaline; gradual to abrupt transition to underlying beds of stratified gravelly and sandy alluvium.

Some areas have spots that are slightly affected by alkali. Included in a few areas mapped as this soil are small areas of Boyce silt loam.

The natural drainage of this soil is poor. Runoff is very slow, and there is no erosion hazard. Permeability is moderately slow in the subsoil. Fertility and the moisture-holding capacity are high. Roots penetrate deeply. The soil is easy or fairly easy to irrigate but is fairly difficult or difficult to work.

This soil is best suited to plants used for hay and pasture. If it is drained, it is suited to potatoes, alfalfa, barley, and wheat. *Capability unit IIIw-1*

**Boyce silt loam** (Bs).—This soil occurs on nearly level flood plains in areas similar in shape to those of Boyce silty clay loam. In many places it is slightly above areas of Boyce silty clay loam but is below areas of Powder silt loam, Stearns silt loam, and Crooked sandy loam, 0 to 2 percent slopes. A few of the lower lying areas are often flooded for short periods in spring.

About 300 acres of this soil are strongly sodic. This acreage generally occurs in patches that are away from streams, are slightly higher than most of this soil, and are close to areas of Stearns silt loam and Crooked soils. Included in areas mapped as Boyce silt loam are some areas where the surface layer is loam and a few where it is fine sandy loam.

This soil has very slow runoff, is only slightly susceptible to erosion, and has poor natural drainage. The moisture-holding capacity and fertility are high. Root growth is deep. Irrigating and working the soil are easy or fairly easy.

This soil is best suited to shallow-rooted plants for hay and pasture. If adequate drainage is provided, and if alkali areas are reclaimed, the soil is suited to potatoes, alfalfa, and small grain. *Capability unit IIIw-1*

**Boyce silt loam, ponded** (Bw).—This soil is in oxbows, sloughs, and old stream channels where water stands on or at the surface most of the year. The soil is more mottled in the surface layer than Boyce silty clay loam, and generally it is free of lime and alkali. In a few small areas included with this soil, the surface layer is silty clay loam.

Natural drainage is very poor. Water ponds on the surface, and there is no erosion hazard. The moisture-holding capacity and the fertility are high. Roots penetrate to a moderate depth.

*Figure 8.*—**Irrigated pasture on Bakeoven very stony loam, 0 to 20 percent slopes.**

The plant cover on this soil consists mainly of willows and cattails, but grasses and sedges grow along the higher edges. Unless the soil is drained, it is too wet for cultivation and is not suited to crops other than water-tolerant plants used for pasture. If drained and leveled, the soil would be slightly difficult or difficult to irrigate. *Capability unit Vw–1*

**Boyce loam, light-colored variant** (Br).—Most of this soil is on the flood plain of McKay Creek and other small streams that drain through the terrace north of Prineville. The soil occurs in long, narrow areas that are 150 to 600 feet wide and ½ to 2 miles long. The surface layer is loam or silt loam, and the depth to sand and gravel ranges from 36 to more than 60 inches.

This soil is poorly drained. During much of the growing season, it is saturated with free water that causes a slight accumulation of alkali in the surface layer. Runoff is very slow, and erosion is not a hazard. The moisture-supplying capacity is very high or high, and fertility is high. Roots penetrate deeply. This soil is slightly difficult to irrigate and is difficult to work.

In undrained areas the plant cover is mainly cattails, rushes, sedges, saltgrass, and other water-loving plants. Unless the soil is adequately drained, it is poorly suited to all crops except those that are used for hay and pasture and are moderately tolerant of water. *Capability unit IIIw–1*

## Courtrock Series

The Courtrock series consists of light-colored, well-drained soils that occupy alluvial fans, chiefly in the areas of Barnes Butte, Johnson Creek, McKay Creek, Lytle Creek, and Lone Pine. These soils were formed mainly in sediments derived from mixed basaltic and tuffaceous materials, but they have a small amount of pumice mixed into the surface layer. The principal plants are sagebrush, perennial grasses, and scattered juniper.

The Courtrock soils have a surface layer of light brownish-gray, neutral sandy loam, gravelly sandy loam, or stony sandy loam. The subsoil is brown to yellowish-brown heavy sandy loam to loam. Beneath the subsoil, at a depth of 30 to 36 inches, is light-brown to light yellowish-brown, calcareous gravelly sandy loam or gravelly loam. Sandy loam or gravelly sandy loam underlies these soils at a depth of about 50 inches.

Courtrock soils are used for irrigated crops, dryfarmed crops, and range.

**Courtrock sandy loam, 2 to 6 percent slopes** (CkB).—This soil is on alluvial fans, generally in areas of 10 to 40 acres. In many places it is adjacent to Prineville and Ochoco soils.

Representative profile:

0 to 30 inches, light brownish-gray sandy loam grading to pale-brown loam; soft or slightly hard; neutral in upper part and mildly alkaline in lower part.
30 to 50 inches, light-brown fine gravelly sandy loam to fine gravelly loam; slightly hard; calcareous; moderately alkaline.
50 inches +, light yellowish-brown, stratified and gravelly sandy loam; slightly hard; weakly calcareous; moderately alkaline.

In a few small areas the surface layer is loam, and in an area of about 40 acres it is clay loam.

This soil has slow surface runoff, but it is moderately susceptible to erosion if irrigated. Fertility and the moisture-holding capacity are moderate. The subsoil is moderately permeable, and roots penetrate deeply. This soil is very easily worked and can be irrigated with little difficulty.

Slightly less than half the acreage of this soil is below existing canals and is used for irrigated crops. The soil is well suited to potatoes, alfalfa, and all other crops grown in the survey area. *Capability unit IIe–2*

**Courtrock sandy loam, 0 to 2 percent slopes** (CkA).—This soil is similar to Courtrock sandy loam, 2 to 6 percent slopes. It occurs in areas of 10 to 40 acres that are above areas of Prineville sandy loam, 0 to 2 percent slopes, and Ochoco sandy loam, 0 to 2 percent slopes. Included in areas mapped as this soil are a few small areas that have a surface layer of loam.

This soil has very slow runoff and is subject to only slight erosion. It is very easy to irrigate and to work. Fertility and the moisture-holding capacity are moderate. Root penetration is deep.

Slightly more than half of this soil is below canals and is irrigated. Some of it above canals is dryfarmed to rye for hay or grain, and the rest is in range. This soil is well suited to all crops grown in the Area. *Capability unit IIs–5*

**Courtrock sandy loam, 6 to 12 percent slopes** (CkC).—This soil commonly occurs on the upper part of alluvial fans. In many places it is above Courtrock sandy loam, 2 to 6 percent slopes, and is below Gem very stony loam, 6 to 40 percent slopes, Gem-Searles stony loams, 6 to 40 percent slopes, and other soils on uplands.

This soil is similar to Courtrock sandy loam, 2 to 6 percent slopes. Included is a small acreage that has a loam surface layer and a few areas that are on slopes of as much as 20 percent.

On this soil runoff is slow to medium, but in irrigated areas the hazard of erosion is severe. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. The soil is difficult to irrigate and is slightly difficult to work.

Most of this soil is above present irrigation canals. A small acreage is planted to dryland rye for hay or grain, and the rest is in range. Under irrigation, the soil is best suited to close-growing plants used for pasture. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes because slopes are strong. *Capability unit IIIe–2*

**Courtrock gravelly sandy loam, 0 to 2 percent slopes** (CmA).—This soil has gravelly surface and subsurface layers but in other respects is similar to Courtrock sandy loam, 2 to 6 percent slopes. It generally occurs on the lower end of alluvial fans, just above areas of Powder loam, Metolius loam, 0 to 2 percent slopes, and other soils on flood plains.

This soil has very slow runoff and is only slightly susceptible to erosion. It is very easily irrigated and easily worked, though tillage is hindered by gravel. The moisture-holding capacity and fertility are moderate. Root growth is deep.

About three-fourths of this soil is irrigated, and most of the rest is dryfarmed to rye for hay or grain. The soil is well suited to all crops grown in the survey area. *Capability unit IIs–2*

**Courtrock gravelly sandy loam, 2 to 6 percent slopes** (CmB).—This soil is on alluvial fans, commonly above nearly level Courtrock soils and just below steeper ones. It is similar to Courtrock sandy loam, 2 to 6 percent slopes, but has gravelly surface and subsurface layers.

On this soil runoff is slow but, in irrigated areas, erosion is a moderate hazard. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. The soil is slightly difficult to irrigate and to work.

Most of this soil is above present irrigation canals. Of the dryland acreage, almost half is cultivated to rye for hay or grain, and the rest is in range. The soil is well suited to all crops grown in the Area. *Capability unit IIe–2*

**Courtrock gravelly sandy loam, 6 to 12 percent slopes** (CmC).—Most areas of this soil are at the head of alluvial fans, below areas of sloping to very steep soils on uplands. Except for gravel in the surface and subsurface layers, This soil is similar to Courtrock sandy loam, 2 to 6 percent slopes. Included in areas mapped as this soil are a few small areas that have a gravelly loam surface layer, and in some of these the slopes are as much as 20 percent.

Runoff is slow to medium, but the erosion hazard is severe if the soil is irrigated. Fertility and moisture-holding capacity are moderate. Root penetration is deep. The soil is difficult to irrigate and to work.

Most of this soil is above existing irrigation canals and has a cover of range plants. Under irrigation, the soil is best suited to close-growing plants used for pasture. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes. *Capability unit IIIe–2*

**Courtrock stony sandy loam, 2 to 6 percent slopes** (CoB).—This soil is similar to Courtrock sandy loam, 2 to 6 percent slopes, but has stones and cobbles throughout the profile. It occurs on alluvial fans, generally below areas of Rock land and Courtrock stony sandy loam, 6 to 20 percent slopes. Most of it is near the Crooked River south of Prineville.

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Although runoff is slow, this soil is moderately susceptible to erosion if it is irrigated. It has moderate fertility and moisture-supplying capacity. Roots penetrate deeply. The soil is difficult to irrigate and very difficult to work.

Nearly all of this soil is in range. Under irrigation, the soil is best suited to close-growing pasture plants but is poorly suited to alfalfa, potatoes, and small grain. *Capability unit IVs-2*

**Courtrock stony sandy loam, 6 to 20 percent slopes** (CoD).—This soil is commonly at the head of alluvial fans below Rock land and Gem very stony loam, 6 to 40 percent slopes. In most places it is above Courtrock stony sandy loam, 2 to 6 percent slopes. Almost all the acreage is near the Crooked River south of Prineville and in the vicinity of Lone Pine.

This soil is like Courtrock sandy loam, 2 to 6 percent slopes, but it contains stones and cobbles throughout and is stony or very stony. Included in areas mapped as this soil are a few areas that have a stony loam surface layer.

Runoff is slow to medium, but if the soil is irrigated, the erosion hazard is moderate to severe. The moisture-holding capacity and fertility are moderate. Root penetration is deep. The soil is very difficult to irrigate and to work.

The soil is poorly suited to all irrigated crops except close-growing plants used for pasture. Practically all the acreage is in range. *Capability unit VIe-1*

## Crooked Series

In the Crooked series are imperfectly drained soils that have a hardpan and are affected by alkali. These soils lie mainly on low benches along the Crooked River south and west of Prineville. They formed in moderately coarse textured or medium-textured alluvium derived mainly from pumice and partly from basaltic material. In many places a water table occurs just below the hardpan. The plant cover is mainly saltgrass, giant wildrye, greasewood, and rabbitbrush.

The surface layer is light brownish-gray sandy loam, fine sandy loam, loamy sand, or loam 4 to 6 inches thick. This layer is open and porous; it is strongly affected by alkali, is strongly or very strongly alkaline, and is slightly calcareous.

The subsoil is 6 to 30 inches thick and commonly is fine sandy loam but ranges from loam to loamy sand. It is open and porous but contains more alkali than the surface layer.

Underlying the subsoil at a depth of 12 to 36 inches is a strongly cemented hardpan that is 4 to 30 inches thick but generally is discontinuous. The hardpan probably formed at the water table or just above it. This layer restricts the movement of water and the penetration of roots. Below the hardpan is stratified fine sandy loam, very fine sandy loam, and loam.

The Crooked soils are irrigated and used for crops, hay, and pasture.

**Crooked sandy loam, 0 to 2 percent slopes** (CtA).—In many places this soil occurs just below terrace escarpments and along the edges of flood plains. It occupies areas of 5 to more than 100 acres that generally are 200 to 1,000 feet wide, 1,000 to 4,000 feet long, and irregular in shape. This soil is slightly higher and farther from stream channels than Boyce silt loam, Boyce silty clay loam, and Stearns silt loam.

Representative profile in a cultivated field:

- 0 to 13 inches, light brownish-gray sandy loam; soft; slightly calcareous; very strongly alkaline.
- 13 to 33 inches, light-gray to pale-brown hardpan, cemented strongly in upper part and less strongly in lower part; moderately calcareous; moderately or strongly alkaline.
- 33 to 60 inches, light brownish-gray, stratified fine and very fine sandy loam; slightly hard; moderately calcareous; strongly alkaline.

The surface layer is sandy loam or fine sandy loam. In a few small areas near Jap Creek and Lone Pine Flat, the subsoil is loam or sandy clay loam. The depth to hardpan ranges from 12 to 36 inches. The amount of alkali in this soil varies considerably from place to place; some fields are strongly affected and have many scalds, or barren spots. Included in areas mapped as this soil are a few small areas that have a loamy sand surface layer and are similar to this soil in alkali content.

This soil has very slow runoff, slow or very slow permeability, and low moisture-holding capacity. Because of its alkali content, it is difficult to irrigate and to work. Fertility is low. Root growth is shallow or only moderately deep because of the hardpan.

This soil is best suited to shallow-rooted plants grown for pasture and hay. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes. *Capability unit IIIw-2*

**Crooked sandy loam, 2 to 6 percent slopes** (CtB).—Most of this inextensive soil lies in long, narrow strips along the edge of the low bench northwest of Prineville. A few oblong tracts in the Jap Creek area range from 5 to 70 acres in size. In these positions the soil is affected by excess water that seeps into the subsoil from higher areas.

In many places this soil has a loam or sandy clay loam subsoil, but in alkali content and other respects it is similar to Crooked sandy loam, 0 to 2 percent slopes. In places the surface layer is loamy sand. The depth to the hardpan ranges from 12 to 36 inches.

This soil has slow runoff but is subject to moderate erosion if irrigated. It is difficult or very difficult to irrigate and is difficult to work. The moisture-holding capacity and fertility are low. Root growth is shallow or moderately deep.

Pasture plants and hay are the best suited crops. Alfalfa and small grain are moderately well suited, but potatoes are poorly suited. *Capability unit IIIw-2*

**Crooked loamy sand, 0 to 2 percent slopes** (CsA).—This soil commonly occurs in areas of 5 to 25 acres that are surrounded by other Crooked soils and by Stearns silt loam. It contains more pumice sand and is slightly browner than Crooked sandy loam, 0 to 2 percent slopes. The depth to hardpan is 20 to 36 inches.

This soil has slow or very slow runoff and is only slightly susceptible to erosion. Its moisture-holding capacity is low. Because the intake of water is more rapid than in other Crooked soils, reducing the alkali content by reclamation is fairly easy. The soil is slightly difficult or difficult to irrigate and is slightly difficult to work.

Plants grown for hay or pasture are best suited to this soil. Alfalfa and small grain are moderately well suited, but potatoes are poorly suited. *Capability unit IIIw-2*

**Crooked loam, 0 to 2 percent slopes** (CrA).—This soil occurs in irregularly shaped areas that generally are long and narrow and commonly range from 10 to 40 acres in size. In many places it is adjacent to areas of Boyce soils and Stearns silt loam.

This soil has a gray loam surface layer that is 6 inches thick and grades to a subsoil of grayish-brown loam. Underlying these layers is a hardpan at a depth of 16 to 30 inches.

Runoff is very slow, and the hazard of erosion is only slight. The moisture-holding capacity is moderate. This soil is difficult or very difficult to irrigate and is difficult to work. Because the surface layer and subsoil are medium textured, reducing their alkali content is difficult.

This soil is best suited to plants used for hay and pasture. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes. *Capability unit IIIw–2*

## Day Series

The Day series is made up of red clays that occur on uplands and formed from clay of the John Day formation (*2*). Most of the plant cover is big sagebrush, annual grasses, bluebunch wheatgrass, and scattered juniper.

The surface layer is reddish-brown, granular, neutral clay 2 to 4 inches thick. The subsoil is reddish-brown clay that is very hard when dry and very sticky when wet. At a depth of 30 inches or more, the subsoil is calcareous. The substratum consists of red clay that is many feet thick and is weak in structure.

The Day soils shrink as they dry and form cracks that are 1 to 2 inches wide and, in some places, extend to a depth of 12 to 18 inches. Granular material from the surface layer falls into these cracks. When the soils again are wet, material from the subsoil is pushed upward as the cracks are closed by swelling. In many places this churning of the soil tends to move organic material downward and subsoil material and chips of lime toward the surface.

The Day soils are used as range.

**Day clay, 6 to 40 percent slopes** (DaE).—This soil occupies small tracts of 5 to 10 acres on irregular slopes. It is inextensive in the survey area and occurs mainly north and east of the Prineville terrace. Slopes generally range from 6 to 25 percent but are as much as 40 percent in some places.

Representative profile in a range area:

0 to 3 inches, reddish-brown clay; strong, fine, granular structure; very hard when dry, very sticky when wet; neutral.
3 to 31 inches, reddish-brown clay; hard when dry, very sticky when wet; neutral or mildly alkaline.
31 to 96 inches, red clay; weak structure; very hard when dry, very sticky when wet; hardness increases with depth; neutral or mildly alkaline.

This soil is well drained. It has slow to rapid runoff, is slowly permeable, and has moderate moisture-holding capacity. The fertility is moderate. Root growth is moderately deep.

Most of this soil is in range. The soil is not suitable for irrigation or for dryfarming. It is difficult to plow and can be tilled only within a narrow range of moisture content. *Capability unit VIIs–1*

## Deschutes Series

The Deschutes series consists of sandy, light-colored, well-drained or somewhat excessively drained soils that were derived from pumice and developed under bunchgrasses. The pumice came from volcanic material that erupted from Mt. Mazama and other former volcanoes (*18*). In the Prineville Area these soils occur in the area of Powell Butte and westward to the Deschutes County line. They are porous, are low in organic-matter content, have a neutral surface layer and subsoil, and are rapidly or very rapidly permeable above the bedrock or other material that underlies them. The original plant cover consisted mainly of needlegrass, bluebunch wheatgrass, Indian ricegrass, sagebrush, and juniper.

Deschutes soils have a surface layer of light brownish-gray sandy loam or loamy sand 2 to 8 inches thick. Their subsoil is pale-brown sandy loam or loamy sand 5 to 10 inches thick. Both of these layers are neutral, soft, and pumicy.

The parent substratum is pale-brown or brown, neutral sandy loam or loamy sand that is 4 to 15 inches thick and is soft and pumicy. In many places the substratum is underlain by pale-brown very fine sandy loam, fine sandy loam, or light loam that contains a small amount of pumice. This layer generally is 6 to 12 inches thick, though it is as much as 30 inches thick in a few places. In some places it is calcareous. The depth to basalt bedrock or to gravel is normally 18 to 36 inches, but where these soils overlie soil material that is like an Ayres soil, the depth to hardpan is 30 to 54 inches.

Some areas of Deschutes soils are irrigated and used for crops, hay, and pasture. Part of the acreage is in range, and part is dryfarmed to small grain harvested for hay.

**Deschutes sandy loam, 0 to 2 percent slopes** (DnA).—This is the most extensive of the Deschutes soils. It occurs in areas that are 5 to several hundred acres in size and commonly lie in swales below areas of the very stony Bakeoven soils or below outcrops of basalt.

Representative profile:

0 to 11 inches, light brownish-gray sandy loam; soft; neutral.
11 to 15 inches, pale-brown sandy loam; soft; neutral.
15 to 23 inches, pale-brown light loam or fine sandy loam; hard; neutral or mildly alkaline.
23 inches +, basalt bedrock.

In most places this soil is underlain by basalt. In the Powell Butte area, however, some of it is underlain by tuffaceous sandstone. The depth to bedrock ranges from 18 to 30 inches.

This soil is well drained, is rapidly permeable, and has low moisture-holding capacity. Runoff is very slow, and the erosion hazard is only slight. Fertility is low. The growth of roots is moderately deep. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown in the survey area. *Capability unit IIs–1*

**Deschutes sandy loam, 2 to 6 percent slopes** (DnB).—This soil is extensive and, in many places, occurs between Redmond soils in swales and Bakeoven soils on ridges. Many areas of this soil range from 10 to 50 acres in size.

This soil generally is underlain by basalt, but some of it in the Powell Butte area is underlain by tuffaceous sandstone. Bedrock is 18 to 30 inches below the surface.

On this soil runoff is slow, permeability is rapid, and the moisture-holding capacity is low. The soil is moderately susceptible to erosion if irrigated. It is slightly difficult to irrigate and very easy to work. Fertility is low. Roots penetrate to a moderate depth.

All crops grown in the Area are well suited to this soil. *Capability unit IIe-1*

**Deschutes sandy loam, 6 to 12 percent slopes** (DnC).—Much of this fairly inextensive soil is in long, narrow areas that extend across the slope. These areas are 200 to 400 feet wide and 1,000 to 3,000 feet long. They generally range from 10 to 30 acres in size, and many of them lie below Bakeoven soils and outcrops of rock. A few areas of this soil are on slopes of as much as 20 percent. The depth to bedrock ranges from 18 to 24 inches.

This soil has slow to medium runoff but, if it is irrigated, is subject to severe erosion. It is rapidly permeable, has low moisture-holding capacity, and is low in fertility. Root growth is moderately deep. Irrigating this soil is difficult, and working it is slightly difficult.

Most of this soil is above irrigation canals and is used as range. The soil is best suited to pasture plants. If irrigated, it is moderately well suited to alfalfa and small grain. It is poorly suited to potatoes because it is sloping, shallow, and difficult to farm. *Capability unit IIIe-1*

**Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes** (DsA).—This soil generally occurs in small areas of 5 to 25 acres. In many places the substratum is calcareous in the lower part. The depth to bedrock is 30 to 36 inches. Included in areas mapped as this soil are a few small tracts that have a surface layer of loamy sand.

This soil has very slow runoff and is only slightly susceptible to erosion. It is rapidly permeable, has moderate moisture-holding capacity, and is moderately fertile. Roots penetrate to a moderate depth. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown locally. Most of it is cultivated. *Capability unit IIs-1*

**Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes** (DsB).—This inextensive soil occupies areas of 5 to 50 acres that are mainly east of the Powell Buttes. In many places the lower part of the substratum is calcareous. Bedrock is 30 to 36 inches below the surface. Included in areas mapped as this soil are a few large areas and a few small ones that have a loamy sand surface layer.

This soil has slow runoff but is moderately erodible if irrigated. Permeability is rapid, and the moisture-holding capacity and fertility are moderate. Root growth is moderately deep. The soil is slightly difficult to irrigate but is very easy to work.

This soil is well suited to all crops grown in the survey area. Much of the acreage is above existing irrigation canals. *Capability unit IIe-1*

**Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes** (DoA).—This soil occurs on the lower end, or toe, of the Powell Buttes fan and adjoins nearly level or gently sloping Ayres soils and other Deschutes soils. Several areas of this soil are more than 100 acres in size. The largest is about 600 acres; it is irregular in shape and extends about 3 miles in an east-west direction.

This soil has upper layers like those of Deschutes sandy loam, 0 to 2 percent slopes, and lower layers somewhat like those of Ayres sandy loam, 0 to 2 percent slopes. The surface layer is 12 to 20 inches of pumicy sandy loam. Brown gravelly loam or gravelly clay loam underlies this layer, and a gravelly hardpan occurs at a depth of 30 to 42 inches.

On this soil runoff is very slow, and the hazard of erosion is slight. Permeability is moderately slow above the hardpan. The moisture-holding capacity and fertility are moderate. Root growth is moderately deep. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown locally. About half the acreage is irrigated; most of the rest is in range; and a small part is dryfarmed to rye that is harvested for hay. *Capability unit IIs-3*

**Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes** (DoB).—This soil generally occupies areas of 5 to 50 acres that are below areas of Searles soils and sloping Ayres soils. It is similar to Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes, and occurs above that soil in most places.

Although this soil has slow runoff, it is moderately erodible if irrigated. It has moderate moisture-holding capacity and is moderately fertile. It is very easily worked and can be irrigated with little difficulty.

This soil is well suited to all crops grown locally. Most of the acreage is higher than existing sources of irrigation water and is used mainly as range, but some of it is planted to rye for hay. *Capability unit IIe-3*

**Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes** (DoC).—This inextensive soil is in areas of 5 to 25 acres that lie below areas of Searles soils and above nearly level or gently sloping Ayres soils. It is similar to Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes.

Runoff is slow to medium. If the soil is irrigated, however, the erosion hazard is severe. Fertility and moisture-holding capacity are moderate. The soil is difficult to irrigate and slightly difficult to work.

All of this soil is above existing canals, though it could be irrigated if water were available. Under irrigation, the soil is best suited to close-growing plants used for pasture. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes. *Capability unit IIIe-3*

**Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes** (DpA).—This soil occupies only a small acreage and is mainly in slight depressions on the north side of the Powell Buttes fan. Its upper layers are pumicy sandy loam 30 inches or more thick. The depth to hardpan is 42 to 54 inches.

This soil has very slow runoff and is only slightly susceptible to erosion. It has rapid permeability, moderate moisture-holding capacity, and moderate fertility. It is very easy to irrigate and to work.

All crops grown in the Area are well suited to this soil. *Capability unit IIs-3*

**Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes** (DrA).—This soil occurs in shallow drainageways at the toe of the Powell Buttes fan. It consists of 24 to 30 inches of pumicy sandy loam underlain by mixed gravelly material. The underlying material washed from slopes of the Powell Buttes and consists of loam to clay loam that is gravelly, cobbly, or stony and, in many places, is calcareous. Otherwise, this soil is like Deschutesandy loam, moderately deep over hardpan, 0 to 2 pers cent slopes.

This soil has very slow runoff and is only slightly susceptible to erosion. It is rapidly permeable, has moderate moisture-holding capacity, and is moderately fertile. It is very easy to irrigate and to work.

All crops grown locally are well suited to this soil. *Capability unit IIs-1*

**Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes** (DrB).—This soil occurs in dry, long and narrow drainageways on the Powell Buttes fan. Most areas range from 10 to 30 acres in size and are 150 to 400 feet wide. A few small areas have slopes of as much as 12 percent. The profile of this soil is similar to that of Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes.

This soil has slow runoff, but irrigated fields are moderately susceptible to erosion. It is rapidly permeable and has moderate moisture-holding capacity and fertility. The soil is slightly difficult to irrigate but is very easy to work.

Although this soil is well suited to all crops grown locally, most of it is above present irrigation canals and is used as range. *Capability unit IIe-1*

**Deschutes stony sandy loam, 0 to 2 percent slopes** (DtA).—This soil occurs in the Powell Butte area and is in tracts of 5 to 50 acres that lie below areas of Bakeoven soils and Rock land. The depth to bedrock ranges from 18 to 24 inches.

On this soil runoff is very slow, permeability is rapid, and the hazard of erosion is only slight. The moisture-holding capacity and fertility are low. The soil is slightly difficult to irrigate and, because it is stony, is very difficult to work. Stones may damage machinery and interfere with smoothing and leveling.

This soil is best suited to pasture but is poorly suited to row crops and small grain. Much of the acreage is above existing irrigation canals. *Capability unit IVs-2*

**Deschutes stony sandy loam, 2 to 6 percent slopes** (DtB).—This soil is 18 to 24 inches deep over bedrock. It generally occurs in areas of 5 to 40 acres below Bakeoven soils and Rock land. About 10 percent of the acreage is very stony.

Runoff is slow, and permeability is rapid. The erosion hazard is moderate in irrigated fields. Fertility and the moisture-holding capacity are low. The soil is difficult to irrigate and very difficult to work.

Only a small acreage of this soil is irrigated. The soil is best suited to plants used for pasture, but it is poorly suited to row crops and small grain. *Capability unit IVs-2*

**Deschutes stony sandy loam, 6 to 20 percent slopes** (DtD).—This soil occupies areas of 5 to 25 acres below areas of Rock land and outcrops of basalt. It is 18 to 24 inches deep over basalt bedrock.

This soil has slow to medium runoff, but irrigated fields are subject to severe erosion. It is rapidly permeable, has low moisture-holding capacity, and is low in fertility. It is very difficult to irrigate and to work. The soil is poorly suited to all irrigated crops except plants grown for pasture. *Capability unit VIe-1*

**Deschutes loamy sand, 0 to 2 percent slopes** (DcA).—This soil consists of 18 to 30 inches of pumiceous loamy sand over basalt or other bedrock. In most places it adjoins Bakeoven soils and Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes. Many areas of this soil range from 5 to 10 acres in size, and only a few are larger than 40 acres.

This soil is somewhat excessively drained. It has very slow runoff and is only slightly susceptible to water erosion, but it is moderately erodible by wind unless protected. It has rapid or very rapid permeability and low moisture-holding capacity. Because infiltration is rapid, the soil is slightly difficult to irrigate, but it is very easy to work. The fertility is low. Root growth is moderately deep.

Most of this soil is above existing irrigation canals and is used mainly as range. The soil is well suited to all crops grown in the Area. *Capability unit IIIs-1*

**Deschutes loamy sand, 2 to 6 percent slopes** (DcB).—This soil generally occurs in areas of 5 to 10 acres that are 100 to 300 feet wide. Only a few areas are larger than 40 acres. In many places the soil lies below Bakeoven soils or Rock land and above nearly level Redmond soils in basins and nearly level Deschutes sandy loam. The profile of this soil is similar to that of Deschutes loamy sand, 0 to 2 percent slopes.

This soil has very slow runoff, but it is moderately susceptible to water erosion if irrigated. The hazard of wind erosion is moderate. Permeability is very rapid, and the moisture-holding capacity is low. The soil is very easy to work but is difficult to irrigate because of slope and rapid infiltration. Fertility is low.

Although this soil is well suited to all crops grown locally, most of it is above present irrigation canals and is used mainly as range. *Capability unit IIIs-1*

**Deschutes loamy sand, 6 to 20 percent slopes** (DcD).—Most of this soil is in areas of 5 to 15 acres that lie in deep draws and below areas of Bakeoven soils and outcrops of basalt rock. About 10 percent of the acreage is on slopes of 20 to 40 percent. The profile of this soil is similar to that of Deschutes loamy sand, 0 to 2 percent slopes.

This soil has very slow runoff but, if irrigated, it is subject to severe erosion by water. The hazard of wind erosion is moderate. The soil is very rapidly permeable, has low moisture-holding capacity, and is low in fertility. It is slightly difficult to irrigate and is slightly difficult or difficult to work.

Nearly all of this soil is above existing irrigation canals and is mainly in range. The soil is best suited to dryland grasses and other range plants and to close-growing plants used for irrigated pasture. It is poorly suited to potatoes. *Capability unit IVs-1*

**Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes** (DdA).—This soil occupies areas of 5 to 80 acres on the Powell Buttes fan. It occurs near Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes, and Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes.

Except for the texture of its upper layers, this soil is like Deschutes sandy loam, moderately deep over hardpan 0 to 2 percent slopes. The upper layers are like those of Deschutes loamy sand and are about 20 inches thick. In most places the lower layers of this soil are like the subsoil of Ayres gravelly sandy loam. They are underlain by a hardpan at a depth of 30 to 36 inches. In a few places the lower layers are missing, and the pumicy upper layers directly overlie the hardpan.

This soil is well drained. It has slow or very slow runoff and is only slightly susceptible to water erosion, but the hazard of wind erosion is moderate. The soil has moderately slow permeability and is moderate in fertility and

moisture-holding capacity. It is easily irrigated and very easily worked.

This soil is well suited to all crops grown in the Area but most of it is in range. *Capability unit IIIs–1*

**Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes** (DdB).—This inextensive soil occupies areas that range from 5 to more than 100 acres in size. It occurs near Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes, and it is similar to that soil but is 30 to 42 inches deep to hardpan. About 10 percent of the acreage is on slopes of 6 to 20 percent.

This well-drained soil has slow runoff, moderately slow permeability, and moderate moisture-holding capacity. It is moderately susceptible to both wind and water erosion. It is easily worked but cannot be irrigated easily. The fertility is moderate.

This soil is well suited to all crops grown locally. Most of it is used as range. *Capability unit IIIs–1*

**Deschutes stony loamy sand, 0 to 6 percent slopes** (DmB).—This soil consists of 18 to 24 inches of stony, pumiceous loamy sand over basalt or other bedrock. It generally occurs in areas of less than 5 to 25 acres, though a few areas are larger than 40 acres. In many places this soil adjoins areas of Rock land and Bakeoven soils.

This soil is somewhat excessively drained. It has very slow runoff, very rapid permeability, and low moisture-holding capacity. It is moderately susceptible to wind erosion and, if irrigated, is subject to slight or moderate washing. Fertility is low. The soil is very difficult to irrigate and to work.

This soil is poorly suited to row crops and small grain. It is best used for pasture. *Capability unit IVs–2*

**Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes** (DvB).—This complex is made up of Deschutes sandy loams and Bakeoven very stony sandy loam in about equal acreages. The Deschutes soils are on 0 to 2 and on 2 to 6 percent slopes, and the Bakeoven soil is on 0 to 6 percent slopes. These soils are so closely intermingled that mapping them separately is impractical. Areas of the complex range from 10 to 100 acres in size, and more than half of them are larger than 25 acres. About three-fourths of the acreage lies west of the Dry River.

The Deschutes soils were derived from pumice and are 18 to 30 inches deep. They occur in small pockets or basins within areas of Bakeoven very stony sandy loam. The Bakeoven soil was derived from basalt bedrock and is only 8 to 12 inches deep.

Runoff is slow or very slow on the Deschutes soils and is slow on the Bakeoven soil. The moisture-holding capacity and fertility are low for the Deschutes soils and are very low for the Bakeoven soil. All the soils are only slightly susceptible to erosion.

Although the Deschutes soils are suitable for cultivation, the soils of the complex are so intermingled that irrigating them is very difficult. *Deschutes soils: capability units IIs–1 (0 to 2 percent slopes) and IIe–1 (2 to 6 percent slopes); Bakeoven soil: capability unit VIIs–2*

**Deschutes-Bakeoven very stony sandy loams, 0 to 6 percent slopes** (DuB).—This complex has a small total acreage and occupies only a few areas, which range from 15 to 30 acres in size. The complex is similar to Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes, but the soils are so stony that they are commonly called scabland, and the Deschutes soil is 18 to 24 inches deep instead of 18 to 30 inches deep.

Runoff is slow or very slow on the Deschutes soil and is slow on the Bakeoven soil. In the Deschutes soil the moisture-holding capacity and fertility are low; in the Bakeoven soil they are very low. Both soils are only slightly susceptible to erosion.

These soils are not suitable for cultivation but can be used for range. *Capability unit VIIs–2*

## Elmore Series

The Elmore series consists of well-drained, moderately dark colored soils on hilly and steep uplands. These soils were derived from rhyolite and developed under a cover of Idaho fescue, bluebunch wheatgrass, sagebrush, and bitterbrush.

The surface layer of the Elmore soils is slightly acid, grayish-brown to dark grayish-brown very stony loam 5 to 10 inches thick. The subsoil of dark-brown heavy loam to clay loam is very stony and is slightly calcareous in the lower part. Rhyolite bedrock occurs at a depth of 2 to 5 feet. It is nearest the surface on hilltops and is at the greatest depth toward the foot of steep slopes.

The Elmore soils are in range.

**Elmore very stony loam, 6 to 40 percent slopes** (EmE).—This soil is at elevations above 3,400 feet on the east and north slopes of the Powell Buttes. It generally occupies areas that range from 50 to 400 acres in size. Slopes ordinarily range from 20 to 40 percent and vary considerably in length. In many places they are 300 to 2,000 feet long.

Representative profile:

0 to 9 inches, grayish-brown very stony loam; soft or slightly hard; slightly acid.
9 to 50 inches, dark-brown, very stony heavy loam to clay loam; slightly hard or hard; slightly acid to mildly alkaline; slightly calcareous in seams and nodules in lower part.
50 inches +, rhyolite rock.

This soil has slow to rapid runoff, and it is likely to erode moderately or severely if unprotected. It is moderately slow in permeability and has moderate moisture-holding capacity and fertility. The growth of roots is moderately deep or deep.

Because this soil contains many stones and is strongly sloping to steep, it is not suitable for cultivation. Its best use is range. *Capability unit VIIs–4*

## Forester Series

The Forester series consists of light-colored, imperfectly drained soils that are sandy in the surface layer and subsoil and are affected by alkali. These soils occupy low, nearly level terraces along the Crooked River near Prineville. They developed in alluvium derived mainly from pumice under a cover of greasewood and saltgrass.

The Forester soils have a light brownish-gray sandy loam or loamy sand surface layer 4 to 8 inches thick. It is calcareous, slightly to strongly alkali, and high in content of pumice. The upper subsoil is similar to the surface layer but is 4 to 12 inches thick. Pale-brown sandy loam or loamy sand makes up the lower subsoil below a depth of 8 to 20 inches. The underlying material is stratified

silt loam to sandy loam. In some places alluvial layers below a depth of 2½ to 6 feet are low in pumice content.

Forester soils are used for irrigated crops, hay, and pasture.

**Forester loamy sand** (Fo).—This soil occurs in areas that range from less than 5 to 50 acres in size. Most areas are nearly level, but a few small ones are gently sloping.

Representative profile:

0 to 12 inches, light brownish-gray loamy sand; soft; very strongly alkaline; moderately or strongly calcareous.
12 to 27 inches, pale-brown loamy sand; soft; strongly or very strongly alkaline; strongly calcareous.
27 to 48 inches, pale-brown very fine sandy loam; slightly hard or hard; strongly alkaline; moderately calcareous.
48 inches +, pale-brown, stratified silt loam to sandy loam; slightly hard or hard; strongly alkaline; moderately calcareous.

In many places this soil is slightly affected by alkali. Runoff is very slow, and the hazard of water erosion is only slight, but the soil blows easily if it is left unprotected when dry. In an area near O'Neil, sandy material from this soil has drifted into hummocks around shrubs. Permeability is very rapid, and the moisture-holding capacity and fertility are low. Although the soil is easily penetrated by plant roots, it is slightly difficult to irrigate and to work.

This soil is best suited to plants grown for hay and pasture. It is moderately well suited to alfalfa and small grain and is poorly suited to potatoes. *Capability unit IIIw-2*

**Forester sandy loam** (Fr).—This soil is mainly in nearly level areas of 5 to 50 acres. It is similar to Forester loamy sand but has a sandy loam surface layer. The accumulation of alkali in this soil ranges from slight to strong, and it can increase rapidly. Areas that have many barren spots are strongly affected by alkali.

Under irrigation, this soil is only slightly susceptible to erosion. It has very slow runoff, rapid permeability, and moderate moisture-holding capacity. Fertility is moderate. The soil is slightly difficult to work and, because of its alkali content, is slightly difficult to irrigate.

This soil is best suited to plants used for hay and pasture. It is moderately well suited to alfalfa and small grain but is poorly suited to potatoes. *Capability unit IIIw-2*

## Gem Series

In the Gem series are rolling to steep, moderately dark colored, stony soils that developed from material weathered from basalt. These soils are mainly in the Lone Pine area, on the watersheds of McKay and Johnson Creeks, and in the area south of Prineville. The original plant cover consisted chiefly of Idaho fescue, bluebunch wheatgrass, sagebrush, bitterbrush, and scattered juniper.

The Gem soils have a surface layer of grayish-brown stony loam, very stony loam, or stony clay loam, 4 to 8 inches thick. This layer has granular structure and is slightly acid or neutral. The subsurface layer is grayish-brown, neutral very stony loam or very stony clay loam 4 to 10 inches thick. The subsoil is brown to light yellowish-brown stony or very stony clay loam that is hard when dry and is not readily permeable to water and roots. Basalt bedrock occurs at a depth of 1 to 3 feet.

These soils are used as rangeland.

**Gem very stony loam, 6 to 40 percent slopes** (GbE).—Nearly half the acreage of this soil is in the Lone Pine area. The rest is in the watersheds of McKay and Johnson Creeks and in an area south and east of Prineville. Most areas of this soil range from 30 to 100 acres in size, but a few are larger than 200 acres.

Representative profile:

0 to 9 inches, grayish-brown very stony loam; hard; slightly acid or neutral.
9 to 20 inches, brown to dark-brown stony clay loam; hard; neutral or mildly alkaline.
20 to 28 inches, brown stony clay loam; hard; neutral to moderately alkaline; calcareous in the lower part.
28 inches +, basalt rock.

The surface layer is slightly darker on northerly slopes than it is on southerly slopes. The depth to bedrock ranges from 12 to 26 inches.

On this soil runoff is slow to rapid, permeability is moderately slow, and the hazard of erosion is moderate to severe. The soil has low to moderate fertility and moisture-holding capacity. Root growth is shallow to moderately deep.

This soil is above irrigation canals and is used for grazing in spring and fall. It is not suitable for cultivation. *Capability unit VIIs-4*

**Gem stony loam, 6 to 20 percent slopes** (GaD).—This inextensive soil is commonly in areas 5 to 30 acres in size. It is less stony than Gem very stony loam, 6 to 40 percent slopes, but in other respects is similar to that soil.

On this soil runoff is slow to medium, and the erosion hazard is moderate. The moisture-holding capacity and fertility are low to moderate.

This soil is not suitable for irrigation. It is difficult to cultivate but can be reseeded. *Capability unit VIe-2*

**Gem-Day stony clay loams, 12 to 40 percent slopes** (GcE).—Nearly all of this complex is in the McKay Creek watershed north of Prineville. One area accounts for about half the total acreage.

About three-fourths of the complex is Gem stony clay loam, and the rest is Day clay. These soils are mapped together because they are so closely intermingled. Except for texture of the surface layer, the Gem soil is similar to Gem very stony loam, 6 to 40 percent slopes.

The soils of this complex have medium to rapid runoff and are moderately to highly erodible. Permeability is moderately slow in Gem stony clay loam and is slow in Day clay. These soils are not suitable for cultivation, because slopes are steep. In addition, the Gem soil is stony, and the Day is clayey. The soils are best used for grazing, but the cover of grass and other plants is more sparse on the Day soil than on the Gem soil. *Gem soil: capability unit VIe-2; Day soil: capability unit VIIs-1*

**Gem-Searles stony loams, 6 to 40 percent slopes** (GgE).—The soils in this complex are so closely intermingled that mapping them separately is not practical. Gem stony loam accounts for 60 percent or more of the acreage, and Searles stony loam makes up the rest. The Gem soil is similar to Gem very stony loam, 6 to 40 percent slopes, but it is less stony.

The soils of the complex have slow to rapid runoff; they are moderately or highly susceptible to erosion. Their moisture-holding capacity and fertility are low to moderate.

This complex is used as rangeland. *Gem soil: capability unit VIe-2; Searles soil: capability unit VIe-1*

## Lamonta Series

The Lamonta series consists of well-drained soils on alluvial fans that have a moderately dark colored surface layer and a clay subsoil underlain by a hardpan. These soils developed in alluvium that washed from soils derived from rhyolite, tuff, and basalt. The plant cover is mainly sagebrush, bluebunch wheatgrass, and scattered juniper.

The Lamonta soils have a surface layer of light brownish-gray loam, gravelly loam, or stony loam, 4 to 8 inches thick. This layer is granular in structure and is neutral.

The upper subsoil is brown, slightly acid clay 2 to 8 inches thick. The lower subsoil of brown, yellowish-brown, or reddish-brown clay is mildly alkaline and, in many places, is gravelly. Underlying the subsoil at a depth of 18 to 30 inches is a gravelly, indurated hardpan that generally is 20 inches or more thick.

In the Prineville Area the Lamonta soils are northwest of Lytle Creek and occupy less than 640 acres. Some areas are irrigated and used for crops, hay, and pasture, and some are in range.

**Lamonta gravelly loam, 6 to 12 percent slopes** (LgC).—This soil is at the upper end, or head, of alluvial fans. In most places it lies below the Searles soils and adjoins Lamonta stony loam, 6 to 20 percent slopes. In the Prineville Area only a few tracts have been mapped; these range from 5 to 50 acres in size.

Representative profile:

0 to 7 inches, light brownish-gray gravelly loam; slightly hard; neutral.

7 to 23 inches, brown clay; hard; mainly neutral, but mildly alkaline in the lower 3 inches.

23 to 36 inches +, pale-brown to light-gray, indurated, gravelly hardpan cemented with silica.

The depth to hardpan ranges from 18 to 30 inches. Included in areas mapped as this soil are areas that have a gravelly clay loam surface layer and make up about 5 percent of the acreage. In addition, less than 5 percent of the included acreage has a fine sandy loam surface layer, and a small acreage is on slopes of 12 to 20 percent.

This soil has slow to medium runoff and is slowly permeable. The erosion hazard is moderate in dryland areas but is severe in irrigated fields. The moisture-holding capacity and fertility are moderate. Root growth is shallow to moderately deep. The soil is difficult to irrigate and to work.

Most of this soil is just above existing canals, but it could be irrigated if water were available. Under irrigation, the soil is moderately well suited to small grain and to plants grown for hay and pasture. It is poorly suited to alfalfa and to potatoes and other row crops. *Capability unit IIIe-4*

**Lamonta loam, 0 to 6 percent slopes** (LaB).—This inextensive soil is in areas of less than 5 to 25 acres that occur at the lower end, or toe, of alluvial fans and are below other Lamonta soils. The soil lacks gravel in the surface layer, but in other respects it has a profile similar to that of Lamonta gravelly loam, 6 to 12 percent slopes. Hardpan is 18 to 30 inches below the surface.

This soil has slow or very slow runoff. It is only slightly erodible in dryland areas but is subject to slight or moderate erosion if irrigated. It has moderate moisture-holding capacity and fertility. Root growth is moderately deep. The soil is slightly difficult to irrigate and is easy or slightly difficult to work.

This soil is poorly suited to potatoes but is moderately well suited to small grain and to alfalfa and other plants grown for hay and pasture. *Capability unit IIe-4*

**Lamonta stony loam, 6 to 20 percent slopes** (LmD).—This soil occurs at the head of alluvial fans. It lies below Searles and Gem soils and, in many places, is next to Lamonta gravelly loam, 6 to 12 percent slopes. About three-fourths of the total acreage is in two areas of 60 to 80 acres each.

This soil has stones throughout the profile, but in other respects it is similar to Lamonta gravelly loam, 6 to 12 percent slopes. The depth to hardpan ranges from 18 to 30 inches. Included in areas mapped as this soil are areas that have a stony clay loam surface layer and that make up about 15 percent of the total acreage.

Runoff is medium, and erosion is a moderate hazard. Fertility and moisture-holding capacity are low. Root growth is moderately deep. The soil is very difficult to work and is not suitable for irrigation. Its best use is range. *Capability unit VIe-1*

## Lookout Series

The Lookout series consists of well-drained, light-colored, generally stony soils that have a loam surface layer and a clay subsoil over a strongly cemented hardpan. These soils lie above and below rimrock escarpments on uplands in Swartz Canyon, on Combs Flat, and along Jap, McKay, and Johnson Creeks. They developed from material weathered from basalt under a cover of bluebunch wheatgrass, Sandberg bluegrass, sagebrush, juniper, and other plants.

The Lookout soils have a 5- to 12-inch surface layer of light brownish-gray, neutral loam, stony loam, or very stony loam. The upper subsoil, 8 to 16 inches thick, is grayish-brown to brown clay or heavy clay loam that is stony or very stony. It is neutral or mildly alkaline and is hard when dry. The lower subsoil is a 2- to 8-inch layer of yellowish-brown or light yellowish-brown clay. This is moderately alkaline and calcareous. Below the subsoil is a strongly cemented hardpan that is 2 to 18 inches thick and overlies basalt bedrock at a depth ranging from 18 to 36 inches.

Lookout soils are used for range and for dryland crops.

**Lookout very stony loam, 0 to 40 percent slopes** (LvE).—This soil accounts for about 70 percent of the total acreage of Lookout soils. It is on nearly level plateaus and on steep side slopes along drainageways that dissect the plateaus. The largest area is in the vicinity of Swartz Canyon and is larger than 640 acres in size. Most other areas range from 10 to 100 acres.

Representative profile:

0 to 8 inches, light brownish-gray very stony loam; slightly hard; neutral.

8 to 20 inches, brown very stony clay; hard when dry, very sticky when wet; mainly neutral or mildly alkaline, but moderately alkaline and calcareous in lower 2 inches.

20 to 30 inches, pale-brown hardpan strongly cemented with silica.

30 inches +, basalt bedrock.

In the steepest areas the subsoil has less clay than in other areas and the hardpan is softer. The depth to hardpan generally ranges from 18 to 30 inches, but on some of the steepest slopes the hardpan is missing. In-

cluded in areas mapped as this soil are a few small areas that have a sandy loam or a fine sandy loam surface layer.

This soil has very slow to rapid runoff, and the hazard of erosion is slight to severe. Permeability is slow, and the moisture-holding capacity and fertility are low. Stones prevent the use of tillage implements, but the soil is suited to range. *Capability unit VIIs-1*

**Lookout stony loam, 0 to 6 percent slopes** (LsB).—This soil generally occurs in areas of 10 to 50 acres. In many places it adjoins Lookout very stony loam, 0 to 40 percent slopes, and Lookout stony loam, 6 to 20 percent slopes. The depth to hardpan ranges from 18 to 30 inches. Included in areas mapped as this soil are a few small areas with a sandy loam or a clay loam surface layer.

On this soil runoff is very slow or slow, and the erosion hazard is slight or moderate. The moisture-holding capacity and fertility are low to moderate. The soil has very poor workability and is not suited to irrigation. It is useful only as rangeland. *Capability unit VIe-1*

**Lookout stony loam, 6 to 20 percent slopes** (LsD).—Nearly half the acreage of this soil is near Jap Creek. Most tracts are 20 to 30 acres in size, but a few are smaller and a few are 80 acres or more. The depth to hardpan ranges from 18 to 30 inches. Areas mapped as this soil include a few small areas that have a sandy loam surface layer.

On this soil medium runoff causes a moderate erosion hazard. Fertility and the moisture-holding capacity are low to moderate. The soil has very poor workability and is not suitable for cultivation. It is used entirely for grazing. *Capability unit VIe-1*

**Lookout loam, 0 to 2 percent slopes** (LoA).—All of this soil is in the Combs Flat area and lies on the plateau above stony and very stony Lookout soils. The few tracts in the Area range from 10 to more than 100 acres in size.

The subsoil of this soil has slightly less clay and, in most places, is thicker than that of Lookout very stony loam, 0 to 40 percent slopes. In addition, the surface layer is thicker and contains few or no stones. The depth to bedrock ranges from 24 to 36 inches. Included in areas mapped as this soil are a few areas that have a sandy loam surface layer.

On this soil runoff is very slow, and erosion is only a slight hazard. The moisture-holding capacity and fertility are moderate. Root penetration is moderately deep. Although the soil is slightly difficult to work, it would be easy to irrigate if water were available.

This soil is above present irrigation canals, and much of it has been dryfarmed to rye for grain or hay. Under irrigation, the soil would be poorly suited to potatoes but well suited to all other crops grown in the Area. *Capability unit IIe-4*

**Lookout loam, 2 to 6 percent slopes** (LoB).—This soil is mostly in the areas of Combs Flat and Jap Creek. Only a few tracts occur; they range from 10 to 80 acres in size. The soil profile and its variations are similar to those of Lookout loam, 0 to 2 percent slopes. Included in areas mapped as this soil are a few areas that have a surface layer of sandy loam or clay loam.

This soil has slow runoff, and it is only slightly susceptible to erosion in dryland areas. If it is irrigated, however, there is a moderate risk of erosion. The moisture-holding capacity and fertility are moderate. Working this soil is slightly difficult, and irrigating it would be slightly difficult if water were available.

This soil is above existing irrigation canals and, in the Combs Flat area, some of it has been cultivated to dryland rye for grain or hay. Under irrigation, it is well suited to most crops grown locally but is poorly suited to potatoes. *Capability unit IIe-4*

## Metolius Series

The Metolius series consists of light-colored, well-drained or somewhat excessively drained soils on bottom land along small streams and on alluvial fans. These soils developed in alluvial material that was derived from light-colored pumice sand mixed with other material. In the Prineville Area they occur along many drainageways, but their largest acreage is along the Dry and Crooked Rivers and in the Lone Pine area. Big sagebrush and annual and perennial grasses make up most of the plant cover.

The Metolius soils have a neutral, light brownish-gray sandy loam, loamy sand, or loam surface layer 6 to 10 inches thick. The subsoil is 8 to 14 inches of neutral or mildly alkaline, light brownish-gray to pale-brown sandy loam or loamy sand. Underlying the subsoil is a substratum of pale-brown to light brownish-gray sandy loam or loamy sand. This layer is 20 to 40 inches thick. It is mildly or moderately alkaline and, in places, is slightly calcareous. Gravel and sand generally occur at a depth of 6 feet or more.

These soils are used principally for irrigated crops, hay, and pasture.

**Metolius sandy loam, 0 to 2 percent slopes** (MsA).—This is the most extensive of the Metolius soils. The largest area occurs along the Dry River and is 150 to 1,300 feet wide, 3 miles or more long, and about 200 acres in size. In addition, there are smaller areas along McKay Creek, Johnson Creek, and other narrow drainageways. These areas generally are 150 to 500 feet wide and less than 1 mile long. Most of them occupy 15 to more than 50 acres, though a few are as small as 5 acres.

Representative profile:

0 to 18 inches, light brownish-gray sandy loam; soft in upper part, slightly hard in lower part; neutral.

18 to 60 inches +, sandy loam that is pale brown in the upper part and light brownish gray in the lower part; soft; mildly alkaline.

In areas along small intermittent drainageways north of Prineville, this soil contains less pumice than in other areas and has greenish chips and pebbles of tuff throughout the profile. The depth to gravel is 5 feet or more.

This soil is well drained. It has very slow runoff, is rapidly permeable, and is only slightly susceptible to erosion. Fertility and the moisture-holding capacity are moderate. Root growth is deep. Irrigating this soil and working it are very easy.

Except in the Dry River area, where frost is a hazard to potatoes, this soil is well suited to all crops grown in the Prineville Area. *Capability unit IIs-5*

**Metolius sandy loam, 2 to 6 percent slopes** (MsB).—Most of this soil is in tracts of 10 to 40 acres near Lone Pine and along the Dry River, the Crooked River, and intermittent drainageways north of Prineville. The soil is similar to Metolius sandy loam, 0 to 2 percent slopes. Areas in small intermittent drainageways, north of Prineville, contain less pumice than other areas and have

greenish chips and pebbles of tuff throughout the profile. The depth to gravel or sand is 5 feet or more.

On this soil runoff is slow, permeability is rapid, the erosion hazard is moderate, and natural drainage is good. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. The soil is easily worked and can be irrigated with little difficulty.

Except in the Dry River area, where frost is a hazard to potatoes, this soil is well suited to all crops grown in the Area. *Capability unit IIe-2*

**Metolius sandy loam, 6 to 12 percent slopes** (MsC).—Most of this soil occurs in areas of 10 to 40 acres near Lone Pine and between Prineville and Combs Flat. The soil has a lower content of pumice and a higher content of basaltic material than Metolius sandy loam, 0 to 2 percent slopes. Sand or gravel is at a depth of 5 feet or more.

This soil is naturally well drained. It has rapid permeability and is easily penetrated by roots. Runoff is slow to medium, and the hazard of erosion is moderate to severe in irrigated fields. The moisture-holding capacity and fertility are moderate. The soil is difficult to irrigate and slightly difficult to work.

This soil is best suited to close-growing plants used for pasture. It is moderately well suited to alfalfa and small grain but, because of slope, is poorly suited to potatoes. *Capability unit IIIe-2*

**Metolius sandy loam, 12 to 20 percent slopes** (MsD).—This soil has a small total acreage, and most of it is in areas of 5 to 40 acres between Prineville and Combs Flat. It has a higher content of basaltic material and a lower content of pumice than Metolius sandy loam, 0 to 2 percent slopes. Its total thickness is 5 feet or more.

On this soil runoff is medium, permeability is rapid, and natural drainage is good. Fertility and the moisture-holding capacity are moderate. The soil is difficult to work but could be irrigated if water were available, though irrigation would be difficult and the erosion hazard would be severe.

None of this soil is irrigated. If water is provided, the soil can be used for crops, but it is poorly suited to potatoes and other row crops. Its suitability for hay and small grain varies from moderately good to poor. The best use is range or irrigated pasture. *Capability unit IVe-1*

**Metolius loamy sand, 0 to 2 percent slopes** (MoA).—This soil occurs mainly along the Crooked River and between Prineville and Combs Flat. It is loamy sand throughout, but in other respects it is like Metolius sandy loam, 0 to 2 percent slopes. The depth to underlying sand or gravel is 5 feet or more.

Natural drainage is somewhat excessive, and permeability is very rapid. The soil has very slow runoff and is only slightly erodible by water, but it is moderately susceptible to wind erosion. The moisture-holding capacity and fertility are moderate. Plant roots penetrate deeply. The soil is slightly difficult to irrigate but is very easy to work.

All crops grown locally are well suited to this soil. *Capability unit IIIs-1*

**Metolius loamy sand, 2 to 6 percent slopes** (MoB).—Most of this soil lies along the Crooked River, along intermittent drainageways north of Prineville, between Prineville and Combs Flat, and in the vicinity of Lone Pine. The soil commonly occupies areas of 10 to 40 acres.

Except for its loamy sand texture throughout, the profile of this soil is like that of Metolius sandy loam, 0 to 2 percent slopes. In areas along small intermittent drainageways north of Prineville, the soil has a lower content of pumice than in other areas and contains greenish chips and pebbles of tuff. The depth to a layer restricting the movement of roots and water is 5 feet or more.

This somewhat excessively drained soil has slow runoff and very rapid permeability. It is moderately susceptible to both water and wind erosion. Fertility and the moisture-holding capacity are moderate. The deep root zone is easily penetrated by roots. This soil is difficult to irrigate but is very easy to work.

All crops grown in the survey area are well suited to this soil. *Capability unit IIIs-1*

**Metolius loamy sand, 6 to 12 percent slopes** (MoC).—This soil generally occupies areas of 5 to 15 acres. It is loamy sand throughout, but otherwise it is similar to Metolius sandy loam, 0 to 2 percent slopes. A layer 4 to more than 5 feet below the surface restricts the movement of water and roots.

Natural drainage is somewhat excessive, permeability is very rapid, and runoff is slow to medium. Both wind and water erosion are severe hazards. The moisture-holding capacity and the fertility are low. Roots penetrate deeply. The soil is difficult to irrigate and slightly difficult to work.

This is a poor soil for potatoes. It is moderately well suited to small grain and alfalfa but is best suited to plants used for pasture. *Capability unit IVs-1*

**Metolius loam, 0 to 2 percent slopes** (MaA).—About half the acreage of this soil occurs in a single tract of more than 300 acres in the Lone Pine area. The soil also is extensive along the Dry and Crooked Rivers and in areas north and northwest of Prineville. These tracts cover from 10 to 100 acres.

This soil is 5 feet or more deep. It has a loam surface layer but in other respects is similar to Metolius sandy loam, 0 to 2 percent slopes. In parts of the Lone Pine area, it has a high water table that limits the growth of alfalfa.

The soil is naturally well drained. It has very slow runoff, is moderately permeable, and is only slightly susceptible to erosion. The moisture-holding capacity and fertility are moderate. The soil is easy to irrigate and very easy to work.

Most of this soil is under irrigation. Except along the Dry River, where frost is a hazard, the soil is well suited to potatoes. It is well suited to other row crops, small grain, and most plants grown for hay and pasture. Except in parts of Lone Pine that have a high water table, it is a good soil for alfalfa. *Capability unit IIs-5*

## Ochoco Series

The Ochoco series consists of generally well-drained soils that have a light-colored surface layer and a medium-textured or moderately fine textured subsoil underlain by a hardpan. These soils developed in mixed gravelly material that had some pumice mixed into the upper layers. The vegetation consists mainly of big sagebrush and bluebunch wheatgrass, and there are a few scattered junipers.

Ochoco soils have a surface layer of neutral, light brownish-gray to grayish-brown loamy sand, sandy loam, gravelly sandy loam, loam, or gravelly loam. This layer

is 3 to 8 inches thick. The subsurface layer is neutral, light brownish-gray to pale-brown loamy sand, sandy loam, fine sandy loam, gravelly sandy loam, loam, or gravelly loam. It is 3 to 10 inches thick.

The upper part of the subsoil consists of neutral, light brownish-gray to pale-brown fine sandy loam, loam, or sandy clay loam 3 to 8 inches thick. In many places this layer is gravelly. The lower part of the subsoil is 6 to 18 inches thick, generally is gravelly and mildly alkaline, and commonly is sandy clay loam.

At a depth of 20 to 36 inches, the subsoil overlies a weakly to strongly cemented hardpan that ranges from 4 to 15 inches in thickness. Roots generally form a mat on the hardpan because they cannot penetrate it, but the hardpan is partly softened by prolonged wetting.

The Ochoco soils are used mainly for irrigated crops, hay, and pasture.

**Ochoco sandy loam, 0 to 2 percent slopes** (OmA).—This soil has the largest acreage of the Ochoco soils. Most of it is on the terrace north of Prineville, though about 300 acres are in the vicinity of Lone Pine. Many areas range from 10 to 100 acres in size, but some are as small as 5 acres, and others cover as much as 400 acres. In most places this soil is adjacent to Prineville soils and other Ochoco soils.

Representative profile:

0 to 16 inches, light brownish-gray sandy loam; soft or slightly hard; neutral.
16 to 36 inches, pale-brown heavy fine sandy loam in the upper part, brown gravelly sandy clay loam in the lower part; slightly hard or hard; neutral or mildly alkaline.
36 to 46 inches, pale-brown, weakly to strongly cemented hardpan; moderately alkaline; calcareous.
46 to 60 inches, light-gray to very dark grayish-brown sand, sandy loam, or very gravelly loamy sand; weakly consolidated; moderately alkaline; calcareous.

The surface and subsurface layers are nongravelly, but in many places the subsoil is gravelly. The depth to hardpan ranges from 24 to 36 inches. Included in areas mapped as this soil are areas that have a fine sandy loam surface layer.

Runoff from this soil is slow, and the erosion hazard is only slight. Permeability is moderate or moderately slow in the subsoil, and root growth is moderately deep. The moisture-holding capacity and fertility are moderate. Irrigating this soil and working it are very easy.

This soil is well suited to potatoes, other row crops, small grain, alfalfa and other plants harvested for hay, and plants used for pasture (fig. 9). Most of the acreage is cultivated. *Capability unit IIs-3*

**Ochoco sandy loam, seeped, 0 to 2 percent slopes** (OoA).—This wet soil occupies only a few areas of 5 to 30 acres that lie below steeper Ochoco soils and receive seepage water from higher irrigated soils. Most of these areas are at the head of drainageways on the terrace north of Prineville.

The surface and subsurface layers of this soil are darker and, in places, are thicker than those of Ochoco sandy loam, 0 to 2 percent slopes. In many places the surface layer is slightly affected by alkali. The depth to hardpan ranges from 24 to 36 inches.

During the irrigation season, this soil contains free water in the subsoil. Runoff is very slow, and the erosion hazard is slight. Fertility and the moisture-holding capacity are moderate. The soil is very easy to irrigate, but it is very difficult to work because of excess water.

In most places this soil has a cover of wetland grasses and rushes. Unless drained, it is best suited to pasture and is only moderately well suited to small grain. It is a poor soil for potatoes and alfalfa. *Capability unit IIIw-1*

**Ochoco sandy loam, 2 to 6 percent slopes** (OmB).—Almost all of this soil lies below nearly level Ochoco and Prineville soils and above steeper Ochoco soils on the terrace north of Prineville and in the Lone Pine area. The soil occurs in many small tracts of 5 to 15 acres and in some larger ones, though only a few cover more than 80 acres.

This soil has a hardpan at a depth of 24 to 30 inches, but otherwise it is similar to Ochoco sandy loam, 0 to 2 percent slopes. The depth to hardpan is least on the ridgetops and is greatest in other areas.

On this soil runoff is slow, and the erosion hazard is moderate. The moisture-holding capacity and fertility are moderate. The soil is slightly difficult to irrigate but is very easy to work.

All crops grown in the Area are suited to this soil. Most of the acreage is cultivated. *Capability unit IIe-3*

**Ochoco sandy loam, 6 to 12 percent slopes** (OmC).—This soil generally occurs in areas of 5 to 25 acres. In many places it is in bands that lie above drainageways and are 150 to 500 feet wide and one-fourth to one-half mile long. Except for its 20- to 30-inch depth to hardpan, this soil is similar to Ochoco sandy loam, 0 to 2 percent slopes.

Water erosion is a severe hazard, and the soil is moderately erodible by wind. It has moderate moisture-holding capacity and fertility. Runoff is slow to medium. The soil is difficult to irrigate and slightly difficult to work.

This soil is best suited to close-growing pasture plants, and it is moderately well suited to alfalfa and small grain. It is poorly suited to potatoes because of slope. *Capability unit IIIe-3*

**Ochoco gravelly sandy loam, 0 to 2 percent slopes** (OhA).—Most of this soil is on the terrace north of Prineville, but part of it is on terraces along the Crooked River. The soil generally occupies areas of 5 to 25 acres. It occurs on slight ridges that adjoin areas of Ochoco sandy loam, 0 to 2 percent slopes, and along the edge of terrace escarpments that consist of steeper Ayres and Ochoco soils.

This soil is gravelly throughout and is 20 to 36 inches deep over hardpan. In other respects it is similar to Ochoco sandy loam, 0 to 2 percent slopes. Included in areas mapped as this soil are a few small areas that have a gravelly loam surface layer.

Runoft from this soil is very slow, and the erosion hazard is slight. The soil has moderate moisture-holding capacity and fertility. It is easy to irrigate and slightly difficult to work.

This soil is well suited to all crops grown in the survey area, but potatoes are somewhat difficult to produce because of gravel. *Capability unit IIs-3*

**Ochoco gravelly sandy loam, 2 to 6 percent slopes** (OhB).—This soil generally lies above terrace escarpments of steeper, gravelly Ayres and Ochoco soils. Most of the acreage is on the terrace north of Prineville, and the rest is on terraces along the Crooked River and in the Lone Pine area. The soil commonly is on short slopes and occurs in areas of 5 to 20 acres. In many places slopes are only 150 to 400 feet long. Except for its slope, its content of gravel throughout, and its 20- to 36-inch depth to hardpan,

*Figure 9.*—**Alfalfa irrigated from sprinklers on nearly level Ochoco and Prineville soils. Cattle are grazing late in fall.**

the soil is similar to Ochoco sandy loam, 0 to 2 percent slopes.

This soil has slow runoff and is moderately susceptible to erosion. It has moderate moisture-holding capacity and fertility. It can be worked and irrigated with little difficulty.

All crops grown locally are well suited to this soil, but potatoes are somewhat difficult to produce because of the gravel. *Capability unit IIe-3*

**Ochoco loamy sand, 2 to 6 percent slopes** (OdB).—Most of this soil is in areas of 40 to 100 acres that occur between 1 and 2 miles southeast of the community of Powell Butte. Nearby are areas of level and gently sloping Deschutes loamy sand, moderately deep over hardpan.

This soil has a 6- to 12-inch surface layer that is similar to the surface layer of Deschutes loamy sand. The subsoil, however, is like that of Ochoco gravelly sandy loam, 0 to 2 percent slopes, though in many places it is gravelly loam. The depth to hardpan ranges from 20 to 30 inches. Included in areas mapped as this soil are areas on slopes of less than 2 percent that make up about one-third of the total acreage.

On this soil runoff is slow, permeability is moderate, and the hazard of both wind and water erosion is moderate. Fertility and the moisture-holding capacity are low. Root growth is moderately deep. The soil is difficult to irrigate but is very easy to work.

About 20 percent of this soil is irrigated, and the rest is rangeland. All the acreage in range is above existing irrigation canals, but most of it is near them. This soil is well suited to all crops grown in the Area. *Capability unit IIIs-1*

**Ochoco loam, 0 to 2 percent slopes** (OcA).—This soil occurs in areas of 5 to 40 acres on terraces north of Prineville and in the vicinity of Lone Pine. In many places it adjoins other Ochoco soils, and in places it lies below Lamonta soils on alluvial fans.

This soil and Ochoco sandy loam, 0 to 2 percent slopes, differ in the texture of their surface and subsurface layers and subsoil, but in other respects the two soils are similar. This soil has surface and subsurface layers of loam and a

subsoil of gravelly sandy clay loam or gravelly loam. The depth to hardpan ranges from 24 to 36 inches.

Runoff from this soil is very slow, and the erosion hazard is slight. The soil has moderate moisture-holding capacity and fertility. It is very easy to irrigate and to work. All crops grown in the area are well suited to this soil. *Capability unit IIs-3*

**Ochoco loam, 2 to 6 percent slopes** (OcB).—This soil occupies only a few areas. These range from 5 to 40 acres in size, and most of them are on the terrace north of Prineville. In most places this soil is adjacent to other Ochoco soils and to Prineville soils.

This soil has surface and subsurface layers of loam and a subsoil of gravelly sandy clay loam or gravelly loam. Otherwise, it is similar to Ochoco sandy loam, 0 to 2 percent slopes. The depth to hardpan is 24 to 36 inches.

On this soil runoff is slow, and the erosion hazard is moderate. Fertility and the moisture-holding capacity are moderate. The soil is slightly difficult to irrigate but is very easy to work.

All crops grown locally are well suited to this soil. *Capability unit IIe-3*

**Ochoco gravelly loam, 2 to 6 percent slopes** (OgB).—This soil is north of Prineville and in the Lone Pine area. Generally, it occupies tracts of 5 to 30 acres that either lie at the head of drainageways or are just above terrace escarpments and below areas of Ochoco sandy loam, 0 to 2 percent slopes.

Except for its gravelly loam surface and subsurface layers and its gravelly sandy clay loam or gravelly loam subsoil, this soil is similar to Ochoco sandy loam, 0 to 2 percent slopes. The depth to hardpan is 24 to 36 inches.

This soil has slow runoff but is moderately susceptible to erosion. It is moderate in moisture-holding capacity and in fertility. Irrigating this soil and working it are slightly difficult.

All crops grown in the area are well suited to this soil, but potatoes are fairly difficult to produce because the soil is gravelly. *Capability unit IIe-3*

## Ontko Series

Soils of the Ontko series are dark colored and poorly or very poorly drained. They occur on bottom land along Mill and Ochoco Creeks north and east of Ochoco Reservoir. These soils developed in mixed alluvium that contained pumice. Their native cover was grasses, sedges, and a small amount of clover. They are subject to frequent flooding, and their water table fluctuates between the depths of 18 and 36 inches during much of the year.

Ontko soils have a surface layer of neutral clay loam or clay that is 4 to 8 inches thick and is black or very dark gray when moist. The subsurface layer is similar to the surface layer but is mottled.

The subsoil is neutral clay loam, gravelly clay loam, or clay 8 to 14 inches thick. This layer is very dark gray or very dark grayish brown when moist. The substratum consists of sand, silt, clay, and gravel in variable amounts. This material does not restrict the growth of roots. Generally, the content of pumice in Ontko soils increases from the surface layer to the substratum.

These soils are commonly used for irrigated hay and pasture, and some areas are kept in native cover.

**Ontko clay loam and clay** (Ot).—This mapping unit commonly occupies areas of 5 to 25 acres and is in nearly level positions that are slightly above areas of Ontko clay loam, ponded.

Representative profile of Ontko clay loam:

0 to 7 inches, clay loam, black when moist; firm and sticky; neutral.
7 to 22 inches, very dark gray clay loam mottled with dark reddish brown and dark olive; firm and sticky; neutral.
22 to 43 inches +, very dark grayish-brown, mottled, stratified loamy coarse sand to silty clay loam; slightly acid to mildly alkaline.

Included in areas mapped as Ontko clay loam and clay are a few small areas that have a loam surface layer. In addition, about 15 percent of the total acreage is gravelly in the surface layer and subsoil.

Runoff is very slow, and there is little or no erosion hazard. Permeability is moderately slow or slow. Fertility is high, and the moisture-holding capacity is very high. Roots penetrate deeply. Irrigation is only slightly difficult, but tillage and harvesting are difficult or very difficult.

These soils are used for hay crops and for grazing in summer. Unless drained, they are poorly suited to most crops grown in the Area. They are best suited to irrigated pasture and to hay plants other than alfalfa. *Capability unit IVw-2*

**Ontko clay loam, ponded** (Op).—This very poorly drained soil generally occupies low, level areas in depressions below Ontko clay loam, and it is similar to that soil. Most areas range from 5 to 25 acres in size. Included in areas mapped as this soil are several small areas in which the upper 16- to 24-inch layer is clay.

Water stands on this soil during much of the year, and there is little or no erosion hazard. In most places the soil is so wet that hay crops cannot be mowed, even with a team of horses. The main plants on it are sedges and rushes. *Capability unit Vw-1*

## Polly Series

In the Polly series are well-drained soils on alluvial fans in and near the Ochoco Mountains. These soils have a moderately dark colored surface layer and a reddish-brown or brown clay loam subsoil. They developed in alluvium that was derived chiefly from tuff and basalt. The plant cover consisted mainly of big sagebrush, bitterbrush, Idaho fescue, bluebunch wheatgrass, and juniper.

The surface layer of Polly soils is neutral, dark-gray or grayish-brown sandy loam, loam, gravelly loam, or stony loam. It is 5 to 12 inches thick.

The upper part of the subsoil is neutral or mildly alkaline, grayish-brown to reddish-brown loam or clay loam 4 to 10 inches thick. In places this layer contains gravel or stones. The lower part of the subsoil consists of hard, reddish-brown clay loam that is 12 to 18 inches thick, is mildly or moderately alkaline and, in many places, is slightly or moderately calcareous.

The substratum is moderately alkaline, brown, pale-brown, or yellowish-red clay loam, loam, or fine sandy loam. In many places this layer contains gravel, and in many places it is calcareous. It does not hinder the movement of water or the growth of roots.

The Polly soils are used principally for dryfarmed grain and as rangeland. A few acres are irrigated and used for crops, hay, and pasture.

**Polly gravelly loam, 6 to 12 percent slopes** (PgC).—In many places this soil is below Gem very stony loam, 6 to 40 percent slopes, and Gem-Searles stony loams, 6 to 40 percent slopes, and is just above Veazie, Ontko, or Courtrock soils. Most areas of this soil range from 5 to 35 acres in size. The largest one covers about 120 acres and is in the vicinity of Lone Pine.

Representative profile:

0 to 6 inches, dark-gray gravelly loam; slightly hard; neutral.
6 to 27 inches, grayish-brown to reddish-brown clay loam that is gravelly in the upper part; hard; neutral to moderately alkaline; slightly or moderately calcareous in the lower part.
27 to 72 inches, yellowish-red to brown clay loam; hard; moderately alkaline; slightly to strongly calcareous.

The coarse fragments of gravel generally are basalt or tuff, but in some places they are rhyolite and andesite. Included in areas mapped as this soil are several areas of 10 to 15 acres that have a cobbly sandy loam surface layer.

This soil has slow to medium runoff and moderately slow permeability. In dryfarmed areas the erosion hazard is moderate, but in irrigated fields it is severe. Roots penetrate deeply. Although the soil has high moisture-holding capacity and fertility, it is difficult to irrigate and to work.

Almost none of this soil is irrigated. About one-third of it has been dryfarmed to small grain for hay or grain, chiefly in the areas of Ochoco Creek and Johnson Creek. The soil is moderately well suited to dryland grain. Under irrigation, it is poorly suited to potatoes but is moderately well suited to small grain and to pasture plants. *Capability unit IIIe-3*

**Polly gravelly loam, 0 to 6 percent slopes** (PgB).—This soil lies on alluvial fans. It generally occupies areas of 5 to 25 acres that are just above soils on the flood plain and are below areas of steeper Polly soils or of Gem, Searles, and other soils on uplands. Most of the acreage is on slopes of 2 to 6 percent.

This soil is similar to Polly gravelly loam, 6 to 12 percent slopes, but its surface layer ranges from gravelly loam to gravelly sandy loam. In areas where the coarser texture occurs, the soil contains more pumice than in other areas. The pebbles and cobbles generally are basalt, but in some places they are rhyolite or andesite.

On this soil runoff is slow or very slow. The erosion hazard is only slight in dryland areas but is moderate in irrigated fields. Moisture-holding capacity and fertility are moderate. The soil is slightly difficult to irrigate and to work.

About 20 percent of the acreage is irrigated, and most of the rest is dryfarmed. The soil is poorly suited to potatoes but is well suited to other irrigated crops and to dryland crops grown in the Area. *Capability unit IIe-4*

**Polly stony loam, 6 to 20 percent slopes** (PlD).—Most of this soil is in tracts of 10 to 25 acres and occurs in the areas of Johnson Creek, McKay Creek, and Lone Pine. In many places the soil lies just below areas of Gem or Searles soils. About three-fourths of the acreage is on slopes of 12 to 20 percent.

This soil is similar to Polly gravelly loam, 6 to 12 percent slopes, but its surface layer and subsoil are stony instead of gravelly. In most places the stones are basalt and tuff, but in a few places they are rhyolite or andesite.

This soil has slow to medium runoff and is moderately susceptible to erosion. It has moderate moisture-holding capacity and fertility. The soil is very difficult to work and is not suitable for irrigation.

About three-fourths of this soil is rangeland, and the rest is dryfarmed. The soil is best suited to range. *Capability unit VIe-2*

**Polly loam, 0 to 6 percent slopes** (PaB).—This soil generally lies at the foot of moderately steep or steep Gem and Searles soils. Most of it is in the areas of Ochoco Creek, Johnson Creek, and Lone Pine, and about three-fourths of it is on slopes of 2 to 6 percent. More than half the areas range from 10 to 25 acres in size. This soil is similar to Polly gravelly loam, 6 to 12 percent slopes, but it is gently sloping and its surface layer and upper subsoil are not gravelly.

On this soil runoff is slow or very slow. The erosion hazard is slight in dryfarmed areas and moderate in irrigated areas. Fertility and the moisture-holding capacity are high. The soil is easily worked and can be irrigated with little difficulty.

About 25 percent of this soil is used for range, and the rest is cultivated, mainly to dryland crops. Although the soil is poorly suited to potatoes, it is well suited to all other crops grown in the survey area. *Capability unit IIe-4*

**Polly loam, 6 to 12 percent slopes** (PaC).—This soil occurs mainly in the areas of McKay Creek, Ochoco Creek, and Mill Creek. In most places it is below steep or moderately steep Gem soils and just above Veazie soils and other soils on alluvial flood plains. Most areas cover from 5 to 25 acres.

Except for its nongravelly surface layer and upper subsoil, this soil is similar to Polly gravelly loam, 6 to 12 percent slopes. Included in areas mapped as this soil are areas that have a clay loam surface layer and make up about 30 percent of the total acreage.

This soil has slow to medium runoff. It is moderately susceptible to erosion in dryland areas but is highly erodible if irrigated and not protected. The moisture-holding capacity and fertility are high. The soil is difficult to irrigate and is slightly difficult to work.

About half of this soil is cultivated, principally to dryland crops, and half is used for range. The soil is not suited to potatoes, but it is moderately well suited to other crops grown in the Area. *Capability unit IIIe-3*

**Polly sandy loam, 2 to 6 percent slopes** (PhB).—This inextensive soil occurs in the Ochoco Creek area, along small streams north of Prineville, and on the high plateau between Prineville and Combs Flat. It occupies areas 5 to 35 acres in size.

The surface layer of this soil is neutral, porous, grayish-brown sandy loam 6 to 8 inches thick. It contains a moderate amount of pumice and a few pebbles. The subsurface layer is neutral, grayish-brown sandy loam or light loam that contains a few pebbles. This layer extends to a depth of about 15 inches. The subsoil is brown or reddish-brown clay loam. At a depth of 30 inches, it is underlain by mixed calcareous gravel, sand, or loamy material that does not prevent the growth of roots or the movement of water.

Although this soil has slow runoff, it is moderately susceptible to erosion if irrigated. The moisture-holding capacity and fertility are moderate to high. The soil is slightly difficult to irrigate but is very easy to work.

Most of this soil is under cultivation. Some of it is dryfarmed, and some is irrigated. The soil is well suited

to all crops grown locally except potatoes. *Capability unit IIe-4*

**Polly sandy loam, thick surface, 2 to 6 percent slopes** (PkB).—This inextensive soil occurs in the areas of Mill Creek and Ochoco Creek, along small drainageways north of Prineville, and on the high plateau between Prineville and Combs Flat. The largest area covers about 60 acres and lies on the high plateau southeast of Prineville. Other areas range from 5 to 30 acres in size.

The surface and subsurface layers of this soil are much thicker than those of Polly sandy loam, 2 to 6 percent slopes. These layers have a total thickness of 2 feet or more, and they contain a moderate amount of pumice sand.

Although this soil has slow runoff, it is moderately susceptible to erosion in irrigated fields. It has moderate to high moisture-holding capacity and fertility. The soil is slightly difficult to irrigate but is very easy to work.

Except on the high plateau southeast of Prineville, some areas of this soil are irrigated, and others are dryfarmed. The soil is well suited to all crops grown locally except potatoes. Figure 10 shows an area of this soil in alfalfa that has been heavily grazed. *Capability unit IIe-4*

**Polly sandy loam, thick surface, 6 to 12 percent slopes** (PkC).—This soil occupies tracts of 5 to 30 acres and is mainly in the areas of Johnson Creek, Mill Creek, and Ochoco Creek. It is similar to Polly sandy loam, 2 to 6 percent slopes, but has thicker surface and subsurface layers. These layers are at least 2 feet thick, and they have a moderate content of pumice sand.

Runoff is slow to medium, but severe erosion is likely to occur in irrigated fields if the soil is not protected. The moisture-holding capacity and fertility are moderate to high. The soil is difficult to irrigate and slightly difficult to work.

About half of this soil is used as range, and most of the rest is dryfarmed. Although the soil is poorly suited to potatoes and other row crops, it is moderately well or well suited to all other crops grown in the Area. *Capability unit IIIe-3*

## Powder Series

The Powder series consists of light-colored, well drained or moderately well drained soils on low, nearly level benches along the Crooked River and Ochoco Creek. These soils developed in mixed alluvium derived mainly from basalt. Giant wildrye and other grasses make up the plant cover.

The Powder soils have a loam, gravelly loam, silt loam, or sandy loam surface layer 5 to 10 inches thick. This layer is neutral and is light brownish gray to grayish brown. The subsoil is similar in color; it consists of porous, mildly alkaline loam or silt loam that is 6 to 15 inches thick.

The upper substratum is grayish-brown to brown silt loam, loam, or fine sandy loam. This layer is moderately alkaline and calcareous. The lower substratum occurs at a depth of 20 to more than 72 inches and is made up of stratified material ranging from silt loam to gravel and sand.

The Powder soils are used for irrigated crops, hay, and pasture.

**Powder loam** (Pm).—This nearly level soil occurs on the flood plain and is generally slightly higher than Powder sandy loam. It commonly occupies areas of 20 to 50 acres, though a few areas are as small as 5 acres. The largest area covers several hundred acres and is between Prineville and the Ochoco Reservoir. In places where this soil has uneven relief because of old stream channels, it is frequently flooded for short periods in spring.

Representative profile:

0 to 6 inches, grayish-brown loam; weak, platy structure; soft or slightly hard; neutral.
6 to 25 inches, grayish-brown loam; soft or slightly hard; mildly or moderately alkaline; calcareous in the lower part.
25 to 80 inches, grayish-brown to gray, stratified silt loam to fine sandy loam; moderately alkaline; calcareous.

The depth to gravel commonly is more than 6 feet.

This soil is well drained. It has very slow runoff and moderate permeability, and it is only slightly susceptible to erosion. The moisture-holding capacity and fertility are high. Roots penetrate deeply. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown locally, and nearly all of it is irrigated. *Capability unit IIc-1*

**Powder gravelly loam** (Pr).—This soil lies in narrow bands along streams. It is closer to the Crooked River and other major streams and to old, abandoned stream channels than are the other medium-textured Powder soils. As a consequence, it is frequently washed or channeled during floods in spring. Sand and gravel occur at a depth of 24 to 36 inches. Included in areas mapped as this soil are small areas that have a surface layer of gravelly fine sandy loam.

This well-drained soil has very slow runoff and moderately rapid permeability. Its moisture-holding capacity and fertility are moderate. The soil is easy or very easy to irrigate but is slightly difficult to work.

This soil is moderately well suited to small grain, to alfalfa and other plants harvested for hay, and to plants used for pasture. It is poorly suited to potatoes. *Capability unit IIe-6*

**Powder silt loam** (Pt).—This nearly level soil occupies areas that generally range from 10 to 75 acres in size and commonly are 400 to 800 feet wide and 1,000 to 5,000 feet long. In many places it is slightly above areas of Boyce soils and is below most other Powder soils.

The surface layer of this soil is silt loam or loam. The depth to sand and gravel ranges from 36 to more than 60 inches. In a few places the soil is noncalcareous throughout. In some places the subsoil and substratum are mottled. Some areas are slightly affected by alkali, and some areas near the Crooked River are cut by old stream channels.

This soil is well drained or moderately well drained. Although it is subject to flooding in spring, there is little or no erosion hazard. Runoff is very slow, permeability is moderate, and the moisture-holding capacity and fertility are high or very high. The soil is very easy to irrigate and is easy or slightly difficult to work.

Wheat, barley, alfalfa, other hay plants, and pasture plants are well suited to this soil. Potatoes are poorly suited. *Capability unit IIe-6*

**Powder silt loam, over gravel** (Pu).—This soil is in areas of 10 to 25 acres that lie mainly along the Crooked River west of Prineville. Most of these areas are adjacent to the river, and many of them are near areas of Powder gravelly loam and Riverwash.

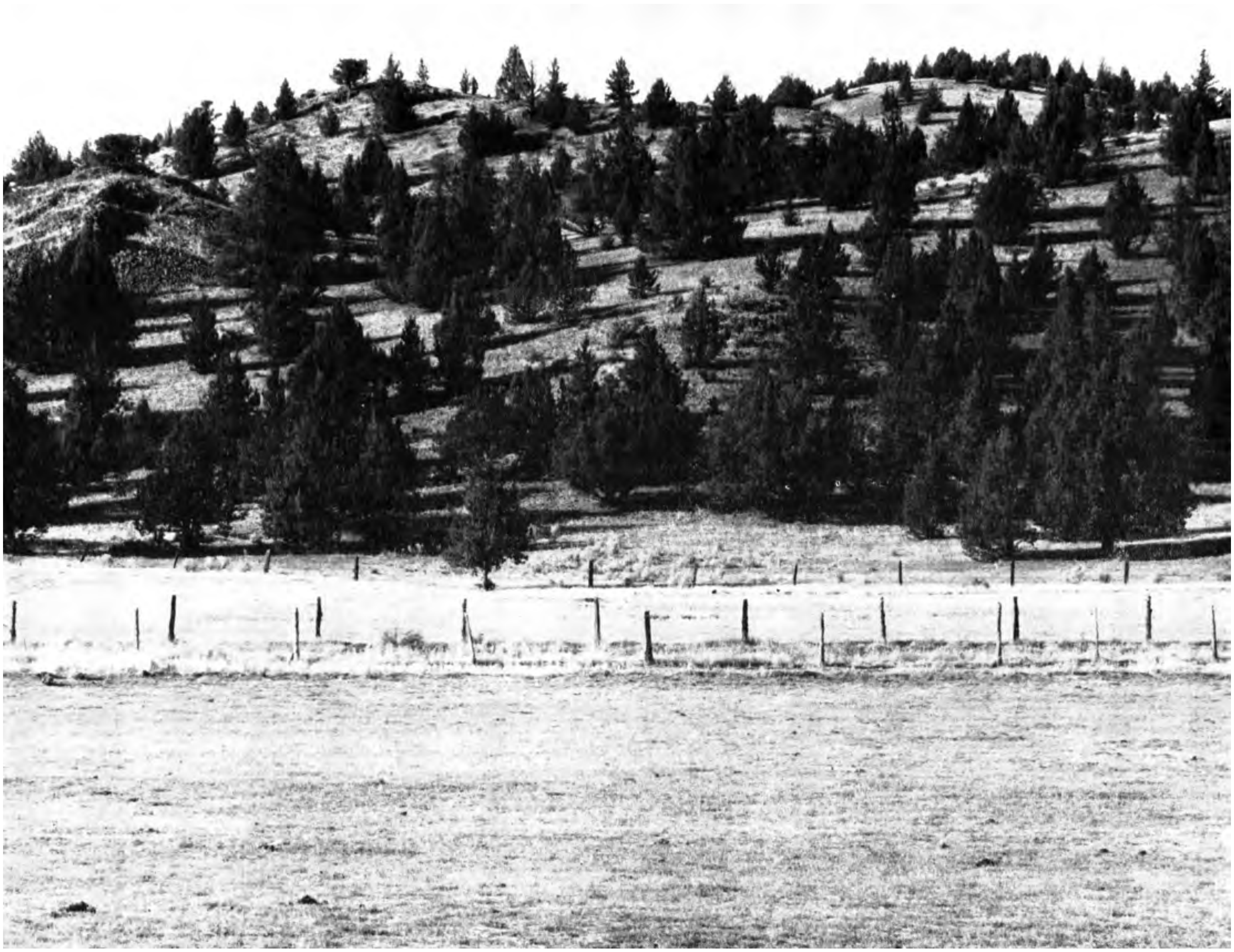

*Figure 10.*—**In the foreground is heavily grazed alfalfa on Polly sandy loam, thick surface, 2 to 6 percent slopes. Trees in the background are junipers.**

The surface layer of this soil is silt loam or loam. The underlying sand and gravel are within 20 to 24 inches of the surface. In some places the soil is noncalcareous throughout all horizons. In many places it is cut by old stream channels and is subject to frequent flooding in spring.

This soil is well drained or moderately well drained and has moderate permeability. Because runoff is very slow, there is little or no erosion hazard. The soil is slightly difficult to irrigate and is slightly difficult or difficult to work. Its moisture-holding capacity and fertility are moderate.

This soil is poorly suited to potatoes but is moderately well suited to all other crops grown in the survey area. *Capability unit IIe–6*

**Powder sandy loam** (Ps).—This nearly level soil commonly occurs on flood plains next to streams. Most areas range from 10 to 40 acres in size, but several are larger than 100 acres. The soil is flooded in spring more frequently than Powder loam, and it has an uneven surface in places where it is crossed by old stream channels.

This soil is moderately coarse textured in the upper 12 to 15 inches, but otherwise it is similar to Powder loam. In most places the depth to gravel is more than 6 feet.

This soil is well drained and is moderately permeable. The moisture-holding capacity and fertility are high. Runoff is very slow. The soil is very easy to irrigate and to work. It is well suited to crops commonly grown in the Area, and nearly all of it is irrigated. *Capability unit IIc–1*

**Powder fine sandy loam, coarse variant** (Pn).—This soil is mainly along the Crooked River and its tributaries northwest of Prineville. In most places it lies between the river and areas of Powder silt loam. The soil is fine sandy loam or very fine sandy loam from the surface to the underlying gravel and sand, which occur at a depth of 24 to 48 inches. Small areas next to slightly lower, wet soils are affected by alkali.

This soil commonly is flooded in spring. It is well drained and has moderate moisture-holding capacity. Permeability is moderately rapid, and runoff is very slow. The soil is moderately fertile, is very easy to irrigate and to work, and can be worked sooner in spring than Powder silt loam.

This soil is well suited to small grain, alfalfa and other hay crops, and plants used for pasture. It is poorly suited to potatoes. *Capability unit IIe-6*

**Powder fine sandy loam, over gravel, coarse variant** (Po).—This soil is in areas on bottom land where the Crooked River has deposited fine sandy loam over gravel. The depth to gravel and sand is 20 to 24 inches. In many places the soil is channeled, for it is frequently flooded in spring.

This soil is well drained or moderately well drained. It has moderately rapid permeability, and its moisture-holding capacity and fertility are low. Runoff is very slow. The soil is easy to irrigate and very easy to work. It is poorly suited to potatoes but is well suited to small grain, to alfalfa and other hay crops, and to plants used for pasture. *Capability unit IIe-6*

## Prineville Series

In the Prineville series are well-drained soils that have light-colored surface and subsurface layers over a moderately coarse textured or coarse textured subsoil that is underlain by a weakly to strongly cemented hardpan. These soils are on the terrace north of Prineville and in the Lone Pine area. They formed in mixed gravel, sand, and silt that were deposited by water. Big sagebrush and bluebunch wheatgrass make up most of the plant cover, and there are a few scattered junipers.

The Prineville soils have a surface layer of soft, neutral, light brownish-gray sandy loam or gravelly sandy loam 5 to 15 inches thick. Their subsurface layer is light brownish-gray fine sandy loam 4 to 12 inches thick. It is soft, gravelly or nongravelly, and neutral or mildly alkaline.

The subsoil is 3 to 14 inches of light brownish-gray fine sandy loam to loamy sand. This layer is gravelly or nongravelly and neutral to moderately alkaline. In many places it is underlain by a parent substratum of pale-brown, slightly calcareous gravelly sandy loam 10 to 30 inches thick.

Below the subsoil or the substratum is a hardpan consisting of massive, or structureless, gravelly or sandy material that is weakly to strongly cemented with lime and silica and is 4 to 30 inches thick. Although it tends to soften if wet for a long time, the hardpan is penetrated by only a few roots and commonly is covered by a mat of them. In many places the depth to the pan ranges from 20 to 36 inches.

The Prineville soils are used principally for irrigated crops, hay, and pasture.

**Prineville sandy loam, 0 to 2 percent slopes** (PvA).—This soil makes up about one-third the acreage of all Prineville soils in the Area. About three-fourths of it is on the terrace north of Prineville, and most of the rest is in the vicinity of Lone Pine. The soil generally occurs in areas of 5 to 40 acres, though a few areas are as large as 75 to more than 100 acres. In many places this soil adjoins areas of Ochoco soils and other Prineville soils.

Representative profile:

- 0 to 9 inches, light brownish-gray sandy loam; soft; neutral.
- 9 to 20 inches, light brownish-gray fine sandy loam; soft or slightly hard; neutral to moderately alkaline.
- 20 to 47 inches, pale-brown very fine sandy loam; lenses of weakly cemented hardpan; slightly calcareous; strongly alkaline.
- 47 to 60 inches, light brownish-gray gravelly loamy fine sand; soft; strongly calcareous.

In most places the subsoil is fine sandy loam. The hardpan is at a depth ranging from 20 to 42 inches and is weakly to strongly cemented. A few small areas are wet because they receive water that moves laterally from irrigated fields nearby. In some areas mapped as this soil and included with it, the surface layer is fine sandy loam, and in a few small areas it is loam or loamy sand.

On this soil runoff is very slow, and the erosion hazard is only slight. Permeability is moderately rapid above the hardpan and is slow in it. Root growth is moderately deep. The soil has low to moderate fertility and moisture-holding capacity. It is very easy to irrigate and to work.

This soil is well suited to all crops grown in the Area. Nearly all the acreage is cultivated. *Capability unit IIs-1*

**Prineville sandy loam, 2 to 6 percent slopes** (PvB).—This soil is mainly in areas of 5 to 30 acres. In many places it lies near drainageways or above terrace escarpments and below areas of nearly level Prineville and Ochoco soils. About two-thirds of the acreage is on terraces north of Prineville, and the rest is in the vicinity of Lone Pine.

Except for its stronger slopes, this soil is similar to Prineville sandy loam, 0 to 2 percent slopes. The subsoil ranges from fine sandy loam to loamy sand. The depth to hardpan ranges from 20 to 42 inches. Because irrigation water moves laterally from adjacent fields, a few small areas of this soil are wet. Included in areas mapped as this soil are areas that have a fine sandy loam surface layer and a few areas that have a loamy sand surface layer.

Although runoff is slow, the erosion hazard is moderate. The moisture-holding capacity and fertility are low to moderate. The soil is easily worked and can be irrigated with little difficulty.

All crops grown locally are well suited to this soil. Most of the acreage is cultivated. *Capability unit IIe-1*

**Prineville sandy loam, 6 to 12 percent slopes** (PvC).—This soil occurs along the edge of terraces and along dry drainageways that are cut into the terraces. Generally, it is in areas of 5 to 10 acres on short slopes.

The profile of this soil is similar to that of Prineville sandy loam, 0 to 2 percent slopes. The depth to hardpan ranges from 20 to 42 inches. Included in areas mapped as this soil are areas with a fine sandy loam surface layer.

Although runoff is slow to medium, this soil is highly erodible if it is irrigated and not protected. It is difficult to irrigate and slightly difficult to work. The moisture-holding capacity and fertility are low to moderate. The soil is poorly suited to potatoes and other row crops, but it is well suited to other crops grown in the survey area. *Capability unit IIIe-1*

**Prineville sandy loam, thick surface, 0 to 2 percent slopes** (PwA).—This soil is mainly in areas above the terrace north of Prineville. It commonly occurs below the steeper Prineville sandy loams that have a thick surface layer.

The upper layers of this soil are thicker than those of Prineville sandy loam, 0 to 2 percent slopes, and in many places they are slightly coarser textured because they contain more pumice. The surface layer is 10 to 15 inches thick. Hardpan occurs at a depth ranging from 42 to 60 inches. Included in areas mapped as this soil are several small areas that have a surface layer of loamy sand.

On this soil runoff is very slow, and the hazard of water erosion is only slight, but wind erosion is a moderate hazard. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown in the Area. It is particularly desirable for potatoes. *Capability unit IIs-2*

**Prineville sandy loam, thick surface, 2 to 6 percent slopes** (PwB).—This soil is in larger areas than other Prineville soils. Some areas cover 40 acres or more. Most of the acreage is above the terrace north of Prineville, but some of it occurs in and near Lone Pine.

Because the upper layers of this soil contain more pumice than those of Prineville sandy loam, 0 to 2 percent slopes, they are slightly coarser textured. The depth to hardpan ranges from 42 to 60 inches. In about one-third of the acreage mapped as this soil and included with it, the upper layers consist of loamy sand 24 inches thick.

Although runoff is slow, there is a moderate hazard of water erosion in irrigated areas. Because of the sandy loam surface layer, the soil is moderately susceptible to wind erosion. The moisture-holding capacity and fertility are moderate. Irrigating the soil is slightly difficult, but working it is very easy.

This soil is well suited to all crops grown in the survey area. It is a particularly good soil for potatoes. *Capability unit IIe-2*

**Prineville sandy loam, thick surface, 6 to 12 percent slopes** (PwC).—This soil is in small areas of 5 to 10 acres and in larger areas of 40 acres or more. In many places it lies below areas of Slayton and Searles soils and above areas of nearly level and gently sloping Prineville and Ochoco soils.

This soil has more pumice in the surface layer than Prineville sandy loam, 0 to 2 percent slopes, but in other respects the two soils are similar. The depth to hardpan ranges from 42 to 60 inches.

This soil has slow to medium runoff but, if it is irrigated, is subject to severe erosion by water. Wind erosion is a moderate hazard. The soil has moderate moisture-holding capacity and fertility. It is difficult to irrigate because of slope, and it is slightly difficult to work.

Close-growing plants used for pasture are best suited to this soil. Alfalfa and small grain are moderately well suited, but potatoes are poorly suited. *Capability unit IIIe-2*

**Prineville gravelly sandy loam, 2 to 6 percent slopes** (PxB).—This soil is inextensive and occupies only a few areas, most of which range from 5 to 15 acres in size. It occurs near the edge of the terrace north of Prineville, below nearly level areas of Prineville and Ochoco soils and above steeper areas of those soils.

This soil is gravelly throughout and sloping, but otherwise it is similar to Prineville sandy loam, 0 to 2 percent slopes. The depth to hardpan is 20 to 36 inches. Included in areas mapped as this soil are areas that have a surface layer of gravelly fine sandy loam.

Under irrigation, this soil is moderately susceptible to erosion, though runoff is slow. Moisture-holding capacity and fertility are low. Roots penetrate to a moderate depth. The soil is slightly difficult to irrigate and to work.

This soil is well suited to all crops grown in the Area, but gravel hinders the growth and harvesting of potatoes. *Capability unit IIe-1*

**Prineville gravelly sandy loam, 6 to 20 percent slopes** (PxD).—This soil occurs in areas of 10 to 40 acres that are mainly on terrace escarpments. In most places slopes are only 150 to 400 feet long. In a few places they are steeper than 20 percent.

This soil is similar to Prineville sandy loam, 0 to 2 percent slopes, but it is gravelly throughout and is 20 to 24 inches deep to hardpan. Included in areas mapped as this soil are small areas of Ochoco soils.

Although runoff is slow to medium, this soil is subject to moderate or severe erosion if it is irrigated. Its moisture-holding capacity and fertility are low. It is very difficult to irrigate and difficult to work.

This Prineville soil is best suited to range grasses or to plants used for irrigated pasture. It is poorly suited to most crops grown locally. Most of the acreage is not cultivated. *Capability unit IVe-1*

## Redmond Series

The Redmond series consists of light-colored, well-drained soils that occur on the upland plateau in the western part of the Area from the Prineville Airport to the Deschutes County line. These soils developed mainly from pumice sand and are in small basins surrounded by higher, stony or rocky areas. The original plant cover was mostly sagebrush, bluebunch wheatgrass, and scattered juniper. The light-colored surface and subsurface layers are over a finer textured subsoil that is underlain by basalt bedrock or other material. In most places a layer of lime has accumulated on top of the bedrock.

The Redmond soils have a surface layer of grayish-brown, pumiceous sandy loam or loam 3 to 8 inches thick. This layer is nonstony to very stony, soft, and neutral. The subsurface layer is 3 to 10 inches thick and slightly hard, but in color, texture, and reaction it is similar to the surface layer.

The upper subsoil, 0 to 8 inches thick, consists of brown heavy sandy loam or loam that is nonstony to very stony and is neutral or mildly alkaline. The lower subsoil is 4 to 10 inches of brown loam, sandy clay loam or clay loam. It is nonstony to very stony and is neutral or mildly alkaline.

The substratum is pale-brown to light brownish-gray loam or heavy sandy loam 5 to 12 inches thick. This material is mildly or moderately alkaline, is calcareous in the lowest few inches, and occurs on basalt or other bedrock. The depth to bedrock ranges from 16 to 36 inches.

The Redmond soils are mainly in range.

**Redmond sandy loam, 0 to 2 percent slopes** (RmA).—This soil accounts for about 40 percent of all the acreage of the Redmond soils. It commonly occupies concave areas below the Deschutes, Bakeoven, and other Redmond soils, and in places it is above Swartz silt loam, which occurs in basins that have no outlet. The total acreage of this Redmond soil is made up of many individual areas.

These areas ordinarily range from less than 5 to 40 acres in size, but a few are larger than 100 acres.

Representative profile:

0 to 11 inches, grayish-brown sandy loam; soft or slightly hard; neutral.
11 to 25 inches, brown heavy sandy loam to sandy clay loam; soft or slightly hard; neutral or mildly alkaline.
25 to 33 inches, brown to light brownish-gray loam; hard; mildly or moderately alkaline; calcareous in the lower few inches.
33 inches +, basalt bedrock.

The depth to bedrock ranges from 20 to 36 inches. Included in areas mapped as this soil are areas that have a fine sandy loam surface layer and a few small areas that have a loamy sand surface layer.

This soil has very slow runoff and is only slightly susceptible to erosion, even in irrigated areas. It is moderate in permeability, moisture-holding capacity, and fertility. Root growth is moderately deep. The soil is very easy to irrigate and to work.

This soil is well suited to all crops grown locally. Irrigation water is not available, however, and many areas are in range, chiefly those between the Dry River and the Deschutes County line. *Capability unit IIs-3*

**Redmond sandy loam, 2 to 6 percent slopes** (RmB).—This gently sloping soil occurs in areas that generally are just above nearly level Redmond soils and, in places, are above Swartz silt loam. Many of these areas range from 10 to 20 acres in size.

This soil is similar to Redmond sandy loam, 0 to 2 percent slopes. The depth to bedrock is 20 to 36 inches. Included in areas mapped as this soil are areas that have a loam surface layer and make up about 15 percent of the total acreage.

Erosion is a moderate hazard in irrigated fields, though runoff is slow. The soil has moderate moisture-holding capacity and fertility. It is slightly difficult to irrigate but very easy to work.

This soil is well suited to all crops grown in the Area. Because no water is available, however, most of the acreage is not irrigated. *Capability unit IIe-3*

**Redmond stony sandy loam, 0 to 6 percent slopes** (RoB).—This soil makes up about 20 percent of the total acreage of Redmond soils. In most places it is below Bakeoven soils and is adjacent to Deschutes soils and other Redmond soils. It commonly occurs in tracts of 10 to 30 acres.

Except for its stony surface and subsurface layers, this soil is similar to Redmond sandy loam, 0 to 2 percent slopes. The depth to bedrock ranges from 20 to 36 inches. Included in areas mapped as this soil are areas that have stony loamy sand surface and subsurface layers and that make up about 10 percent of the total acreage. Also included are areas that have a stony fine sandy loam surface layer.

This soil has slow or very slow runoff, but it is slightly or moderately susceptible to erosion in irrigated fields. Fertility and the moisture-holding capacity are moderate. Irrigation is slightly difficult or difficult, but tillage and harvesting are very difficult. In some areas not under cultivation, the stones can be removed at reasonable expense.

This soil is poorly suited to most crops grown in the Area. If irrigated, it is best suited to plants used for pasture. *Capability unit IVs-2*

**Redmond very stony sandy loam, 6 to 12 percent slopes** (RrC).—In most places this soil lies below Bakeoven soils or adjoins Redmond stony sandy loam, 0 to 6 percent slopes. It commonly occurs in areas of 15 to 30 acres.

This soil is strongly sloping, is very stony throughout, and is only 16 to 30 inches deep over bedrock, but in other respects it is similar to Redmond sandy loam, 0 to 2 percent slopes. Included in areas mapped as this soil are areas that have a very stony loam surface layer.

On this soil runoff is slow to medium, and the erosion hazard is moderate. Fertility and the moisture-holding capacity are low. The soil is too stony for cultivation, and its use is limited to grazing. *Capability unit VIIs-1*

**Redmond loam, 0 to 2 percent slopes** (RdA).—This soil occurs in many individual areas and makes up about 30 percent of the total acreage in Redmond soils. These areas commonly range from 10 to 30 acres in size, but a few are larger than 100 acres. In most places this soil is in swales below Deschutes soils and other Redmond soils, and in places it is above Swartz silt loam, which lies in basins that have no outlet.

This soil is loam in the surface and subsurface layers and the upper subsoil, but otherwise it is similar to Redmond sandy loam, 0 to 2 percent slopes. The depth to bedrock ranges from 20 to 36 inches.

On this soil runoff is very slow, and the erosion hazard is only slight. The soil has moderate moisture-holding capacity and fertility. It is very easy to irrigate and to work. Because irrigation water is not available, many areas are used as range, but the soil is well suited to all crops grown locally. *Capability unit IIs-3*

**Redmond stony loam, 0 to 6 percent slopes** (RnB).—This is the least extensive of the Redmond soils. It generally occurs in areas of 10 to 30 acres and, in many places, adjoins areas of Rock land, Redmond loam, 0 to 2 percent slopes, and stony Redmond or Deschutes soils.

This soil has surface and subsurface layers of stony loam and an upper subsoil of loam, but in other respects it is similar to Redmond sandy loam, 0 to 2 percent slopes. The depth to bedrock ranges from 20 to 36 inches. In about three-fourths of the acreage, slopes range from 0 to 2 percent.

This soil has slow or very slow runoff, but it is slightly to moderately susceptible to erosion if it is irrigated. The moisture-holding capacity and fertility are moderate. The soil is slightly difficult or difficult to irrigate and is very difficult to work.

This soil is poorly suited to most crops grown in the Area. Under irrigation, it is best suited to plants used for pasture. *Capability unit IVs-2*

## Riverwash (Rv)

This mapping unit occurs on alluvial flats, bars, and low levees along streams. It consists of barren deposits of sand and gravel that are subject to shifting when the water is high. The material is droughty and nearly bare of vegetation. Riverwash occurs mainly along the Crooked River. *Capability unit VIIIs-1*

## Rock Land (Rx)

Rock land consists of loose stones, rock outcrops, and very shallow soil between the outcrops (fig. 11). This

*Figure 11.*—An area of Rock land and Deschutes soil under a stand of juniper, sagebrush, and bunchgrasses. Outcrops of basalt rock form similar knolls in many places west of the Dry River.

land type occurs in nearly level to very steep areas that range from five to several hundred acres in size. In most places the areas are so stony and so rocky that using farm machinery on them is impractical.

Rock land has slow to rapid runoff and is moderately susceptible to erosion. It is suitable as range, but its value for grazing is low. *Capability unit VIIs-1*

## Rock Outcrop (Ry)

This miscellaneous land type occurs in areas of less than 5 to several hundred acres and consists mainly of bare bedrock. It has no agricultural value. *Capability unit VIIIs-1*

## Salisbury Series

The Salisbury series consists of shallow to moderately deep, moderately dark colored, well-drained soils on old alluvial fans. These soils have a claypan subsoil underlain by a strongly cemented to indurated hardpan. They formed in gravelly alluvium that washed from higher slopes around Stearns Butte and was derived from basalt. The original plant cover consisted of sagebrush, bitterbrush, Idaho fescue, bluebunch wheatgrass, and juniper.

The surface layer of Salisbury soils is grayish-brown loam or very stony loam, about 4 inches thick. It is granular in structure and is neutral. The subsurface layer is similar to the surface layer but has a higher content of clay.

Below a depth of 8 to 14 inches, the subsoil is brown clay that contains many large, rounded fragments of basalt. This layer takes in water slowly when moist; it may be slightly calcareous in the lower part; and it overlies a hardpan at a depth of 16 to 24 inches. The hardpan commonly is 10 to 24 inches thick. In places it occurs on basalt bedrock.

The Salisbury soils are used as range and for dryland crops of grain.

**Salisbury very stony loam, 0 to 6 percent slopes** (SbB).—This nearly level or gently sloping soil occupies the high plateau a few miles southeast of Prineville. It occurs in only a few areas, but most of them range from 100 to 400 acres in size.

Representative profile:

0 to 8 inches, grayish-brown very stony loam that contains more clay in the lower part; slightly hard; neutral.
8 to 21 inches, dark-brown very stony clay; hard or very hard; neutral or mildly alkaline.
21 to 38 inches, light yellowish-brown, strongly cemented to indurated hardpan; calcareous; moderately alkaline.

The depth to the hardpan ranges from 16 to 24 inches. This soil has slow or very slow runoff, slow permeability, and low moisture-holding capacity and fertility. Erosion is only a slight hazard. Root growth is shallow to moderately deep. The soil is too stony for cultivation and is used for grazing. *Capability unit VIIs-4*

**Salisbury very stony loam, 6 to 20 percent slopes** (SbD).—Nearly all of this soil is in one area southeast of Prineville. The soil has a profile similar to that of Salisbury very stony loam, 0 to 6 percent slopes. Part of the acreage has been cleared of surface stones and was once used for cultivated crops.

This soil has slow to medium runoff and is likely to erode moderately if not protected. Fertility and the moisture-holding capacity are low. The soil is best used for grazing. *Capability unit VIIs-4*

**Salisbury loam, 0 to 6 percent slopes** (SaB).—This soil is inextensive and occurs in only a few areas. These areas range from 5 to 80 acres in size. Most of the acreage has been cleared of surface stones and cultivated, but otherwise the soil is similar to Salisbury very stony loam, 0 to 6 percent slopes. Included in areas mapped as this soil are a few small areas that have a surface layer of pumiceous sandy loam and generally are 4 to 10 inches deeper to hardpan.

On this soil runoff is slow or very slow. The erosion hazard is slight in range areas and is slight or moderate in fields used for dryfarming. Fertility and moisture-holding capacity are low.

This soil is far above irrigation canals. Dryland wheat and rye are grown on some of the acreage. *Capability unit IIe-4*

## Searles Series

The Searles series consists of light-colored, well-drained soils that have a clay loam subsoil. These soils were derived from volcanic tuff and rhyolite on rolling to steep uplands under a cover of bluebunch wheatgrass, sagebrush, and scattered juniper. They occur principally north of Prineville and in the areas of Lone Pine and the Powell Buttes.

The surface layer of these soils is 4 to 6 inches of light brownish-gray to grayish-brown stony loam, clay loam, or sandy loam. This layer is neutral and has granular structure. The subsoil is grayish-brown, brown, or light olive-brown heavy loam or light loam that is very stony or very gravelly. The substratum is slightly calcareous very gravelly or very stony loam. Fragments of tuff or rhyolite occur, their number increasing with depth. Except in severely eroded Searles soils, bedrock of tuff or rhyolite is at a depth of 16 to 40 inches. In places the bedrock is capped by a hardpan that is strongly cemented with lime and silica.

The Searles soils are mainly in range.

**Searles stony loam, 20 to 40 percent slopes** (ScE).—A large acreage of this soil occurs in the Powell Buttes area. In addition, there is a tract of about 500 acres in the Lone Pine area. Most of the remaining acreage is in tracts of 20 to 200 acres north and south of Prineville. Slopes range from 25 to 35 percent in most places.

Representative profile:

0 to 8 inches, grayish-brown stony loam; slightly hard; neutral.
8 to 25 inches, brown to dark-brown very gravelly or very stony loam or clay loam; hard; neutral.
25 to 40 inches, brown very gravelly or very stony loam; hard; neutral; slightly calcareous.
40 inches +, rhyolite bedrock capped by 1 to 4 inches of strongly cemented hardpan of lime and silica.

In a few areas, principally on north-facing slopes, there are few or no stones in the profile. The underlying bedrock is capped by a hardpan only in places. The depth to bedrock ranges from 24 to 40 inches.

On this soil runoff is medium to rapid, permeability is moderately slow, and the erosion hazard is moderate to severe. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. Because the soil is steep and stony, its use is limited to range. *Capability unit VIe-1*

**Searles stony loam, 2 to 20 percent slopes** (ScD).—This soil is commonly in areas of 10 to 50 acres. Most of it is on the Powell Buttes, and the rest is on the buttes north of Prineville. At least three-fourths of the acreage has slopes of more than 6 percent.

This soil is similar to Searles stony loam, 20 to 40 percent slopes, but is not so steep. It is underlain by bedrock at a depth of 24 to 40 inches. A few small areas have few or no stones in the profile.

On this soil runoff is slow to medium, and the risk of erosion is slight to moderate. Because the soil is stony, it is difficult to cultivate and is more suitable for range than for cultivation. *Capability unit VIe-1*

**Searles stony clay loam, 6 to 20 percent slopes** (SdD).—This inextensive soil occurs in small areas of 5 to 20 acres. Its present surface layer is stony clay loam because the original surface layer of loam has been lost through erosion or has been mixed with subsoil material in cultivation. The depth to tuff bedrock is 16 to 32 inches.

This soil has medium to rapid runoff and is moderately susceptible to further erosion. The moisture-holding capacity and fertility are low to moderate. The soil is very difficult to work and is most suitable as rangeland. *Capability unit VIe-1*

**Searles stony clay loam, 20 to 40 percent slopes, severely eroded** (SdE3).—This soil has lost all of its original surface layer and most of its subsoil through erosion. In most places it is 6 to 18 inches deep over tuff bedrock, but in many spots the bedrock is exposed. The soil is inextensive and occurs in only a few areas of 25 to 50 acres.

This soil has rapid runoff and is highly susceptible to further erosion. It is low in fertility and moisture-holding capacity, and it produces little forage. *Capability unit VIIs-3*

**Searles stony sandy loam, 6 to 20 percent slopes** (SeD).—This soil is mainly in tracts of 5 to 30 acres north of Prineville and on the Powell Buttes. In most places

it is below steeper Searles soils and above Ayres, Ochoco, or Prineville soils.

The surface layer of this soil is neutral, grayish-brown to light brownish-gray stony sandy loam 3 to 8 inches thick. This layer has been strongly influenced by a layer of material containing a large amount of pumice. The upper part of the thin subsoil is neutral, brown sandy loam 3 to 10 inches thick. At a depth of 8 to 18 inches is a lower subsoil of clay or clay loam 4 to 12 inches thick. The lower subsoil contains fragments of tuff and is calcareous a few inches above bedrock. The depth to bedrock is only 16 to 24 inches.

On this soil runoff is slow to medium, permeability is moderately slow or slow, and the erosion hazard is moderate. Fertility and the moisture-holding capacity are low. The soil is difficult to cultivate and is best suited to range plants. *Capability unit VIe–1*

**Searles stony sandy loam, 20 to 40 percent slopes** (SeE).—About half of this soil occurs as a single tract on the buttes northeast of Prineville. The rest is in tracts of 10 to 60 acres in the same area and in the vicinity of the Powell Buttes. Except for its surface and subsurface layers of stony sandy loam or stony fine sandy loam, this soil is similar to Searles stony loam, 20 to 40 percent slopes.

This soil has medium to rapid runoff and is likely to wash moderately or severely if left unprotected. It is moderately susceptible to wind erosion. Fertility and the moisture-holding capacity are low. The soil is too stony and too steep for cultivation and is best used as rangeland. *Capability unit VIe–1*

**Searles-Slayton complex, 2 to 20 percent slopes** (SfD).—This complex occurs in areas of 5 to 100 acres. About 60 percent of the acreage is on side slopes and consists of a soil that is similar to Searles stony sandy loam, 6 to 20 percent slopes. The rest is on hilltops and consists of a soil that is like Slayton sandy loam, 2 to 20 percent slopes.

Most of this complex is above present irrigation canals, but a few small areas occur below the canals and are cultivated. *Searles soil: capability unit VIe–1; Slayton soil: capability unit IVe–1*

**Searles-Slayton complex, 20 to 40 percent slopes** (SfE).—At least 50 percent of this complex is Slayton channery sandy loam, 20 to 40 percent slopes, and the rest is a soil that has a profile similar to that of Searles stony sandy loam, 6 to 20 percent slopes. The depth to bedrock is 8 to 16 inches in the Slayton soil and is 16 to 24 inches in the Searles soil. Several areas of 100 acres or more account for most of the acreage in the complex.

These soils are best suited to range because they are steep, stony, and shallow to bedrock. *Capability unit VIe–1*

## Slayton Series

In the Slayton series are light-colored, well-drained soils that occupy low foothills north and northeast of Prineville. These soils were derived from greenish tuff or breccia that was mixed with pumice sand, especially in the upper layers. The original plant cover consisted mainly of bluebunch wheatgrass and needlegrass, but most of these grasses have been replaced by rabbitbrush and cheatgrass.

The Slayton soils have a surface layer of neutral, light brownish-gray sandy loam 2 to 6 inches thick. In this layer are greenish chips and pebbles of tuff, some pumice sand and, in many places, few to many channery fragments. The subsurface layer is 2 to 8 inches thick and is similar to the surface layer, but it contains less pumice and has a higher content of coarse fragments. The subsoil is 4 to 10 inches of neutral, light brownish-gray sandy loam that has more and larger tuff fragments than the upper layers. Bedrock occurs at a depth of 8 to 20 inches.

Nearly all the acreage of Slayton soils is in range.

**Slayton sandy loam, 2 to 20 percent slopes** (SkD).—This soil is on ridges or saddles and in rolling areas. It is mainly in tracts of 5 to 30 acres, though in several areas it covers more than 100 acres. Slopes generally range from 6 to 20 percent.

Representative profile:

0 to 8 inches, light brownish-gray sandy loam; soft; neutral.
8 to 14 inches, pale-brown channery sandy loam; soft; neutral.
14 inches +, light yellowish-green sandy tuff.

The depth to bedrock is 12 to 20 inches.

Although this soil has slow to medium runoff and rapid permeability, it is subject to moderate or severe erosion if it is not protected. The soil is low in fertility and moisture-holding capacity and has a shallow root zone. It is difficult or very difficult to irrigate and is slightly to very difficult to work.

This soil is suited to irrigated pasture and to small grain, but it is poorly suited to potatoes, other row crops, and alfalfa. Most of the acreage is in range. *Capability unit IVe–1*

**Slayton channery sandy loam, 2 to 20 percent slopes** (ShD).—In most places this soil is in areas of 5 to 50 acres that commonly lie below areas of Searles soils or Slayton channery sandy loam, 20 to 40 percent slopes, and above areas of Prineville and Ochoco soils. This soil has many fragments of sandy tuff on the surface and throughout the profile, but in other respects it is like Slayton sandy loam, 2 to 20 percent slopes. The depth to bedrock ranges from 8 to 20 inches.

Runoff is slow to medium, the erosion hazard is moderate, and the moisture-holding capacity and fertility are low. The soil is too stony and too shallow for cultivation, and nearly all the acreage is in range. *Capability unit VIe–1*

**Slayton channery sandy loam, 20 to 40 percent slopes** (ShE).—In many places this soil is above other Slayton soils. It occurs mainly in areas of 10 to 30 acres, though one area covers nearly 200 acres. The soil is similar to Slayton sandy loam, 2 to 20 percent slopes, but it is steeper and has many fragments of sandy tuff on the surface and throughout the profile. The depth to bedrock ranges from 8 to 16 inches.

On this soil medium to rapid runoff causes a moderate or severe hazard of erosion. Fertility and the moisture-holding capacity are low. The soil is used as range; it is too steep, too stony, and too shallow for cultivation. *Capability unit VIe–1*

## Stearns Series

The Stearns series consists of nearly level, light-colored, imperfectly drained soils that developed in alluvium and occupy low terraces along the Crooked River and Ochoco Creek, where the water table is high. These soils have a slowly permeable subsoil that overlies a hardpan weakly cemented by lime. The plant cover is mainly greasewood, saltgrass, giant wildrye, and rabbitbrush.

Stearns soils have a surface layer of light brownish-gray, neutral silt loam that is about 5 inches thick and slightly hard when dry. The subsoil of brown silty clay loam or silt loam is hard, slightly calcareous, and very strongly alkaline. The hardpan occurs at a depth of 12 to 30 inches and is irregular and discontinuous. Below the pan are layers of silt and sand that were deposited by water. Free water occurs at the pan or just below it.

These soils are moderately or strongly alkali and slightly or moderately saline. Grazing is the principal use, though some areas have been reclaimed and irrigated.

**Stearns silt loam** (Sl).—This nearly level soil is in areas that range from less than 5 to 100 acres in size. The smaller areas are irregular in shape but are commonly long and narrow, whereas the larger ones are oblong.

Representative profile:

0 to 5 inches, light brownish-gray silt loam; slightly hard; neutral.
5 to 13 inches, brown silty clay loam; hard; slightly calcareous; very strongly alkaline.
13 to 36 inches, light brownish-gray silt loam; weakly lime-cemented hardpan; slightly to strongly calcareous; very strongly alkaline.
36 to 60 inches, pale-brown, stratified silt loam to fine sandy loam; slightly hard; slightly calcareous; strongly alkaline.

In some places where plowing has mixed the original surface layer with subsoil material, the present surface layer is silty clay loam. The depth to the hardpan ranges from 12 to 30 inches. This soil has a moderate or high content of alkali and is slightly or moderately saline. If cultivated and irrigated, the soil readily puddles.

This soil has very slow runoff and is only slightly susceptible to erosion. It is slowly permeable and has low moisture-holding capacity. The fertility is low. Root growth is shallow. Because of alkali, the soil is difficult to irrigate and to work.

Unless this soil is reclaimed, its use is limited to grazing. *Capability unit IVw-3*

**Stearns-Crooked complex** (Sm).—This nearly level complex is made up of two soils that occur in an intricate pattern. One soil is like Crooked loam, 0 to 2 percent slopes, and the other is like Stearns silt loam. About 75 percent of the complex is in the city of Prineville, and the rest consists of only a few individual areas.

Unless the concentration of alkali is reduced, agricultural use of the soils is limited to livestock grazing. *Stearns soil: capability unit IVw-3; Crooked soil: capability unit IIIw-2*

## Steiger Series

Soils of the Steiger series are nearly level or gently sloping, moderately dark colored, and well drained. These soils are on the forested upland east of Prineville and on alluvial fans above bottom land, mainly along Ochoco Creek. The native vegetation consists chiefly of Ponderosa pine, perennial grasses, bitterbrush, and sagebrush.

Steiger soils have a neutral, grayish-brown sandy loam or loam surface layer 5 to 8 inches thick. The subsurface layer, 6 to 12 inches thick, is sandy loam that is slightly browner and lighter colored than the surface layer. The lower layers consist of sandy loam that is lighter in color and less acid with increasing depth.

These soils are used for grazing in summer.

**Steiger sandy loam** (Ss).—This inextensive soil is generally in small areas of less than 5 to 15 acres. Slopes range from 0 to 6 percent.

Representative profile:

0 to 14 inches, grayish-brown sandy loam; soft or slightly hard; neutral.
14 to 28 inches, brown to pale-brown sandy loam; soft or slightly hard; neutral or mildly alkaline.
28 to 69 inches, pale-brown stratified sandy loam and fine sandy loam; soft; mildly alkaline.

The texture of the surface layer ranges from sandy loam to loam. In about 40 percent of the acreage, the subsoil is pumiceous sand or loamy sand below a depth of about 20 inches, and there are basaltic pebbles below a depth of about 3 feet.

This soil has slow or very slow runoff and rapid permeability. The hazard of erosion ranges from none to moderate, depending on slope. The moisture-holding capacity and fertility are moderate. Roots penetrate deeply. The soil is easily worked and can be irrigated with little or no difficulty.

Most of this soil is in pasture that is grazed mainly in summer. Because the growing season is short and frost is a hazard, potatoes and similar crops are not suitable. *Capability unit IIIs-2*

## Swartz Series

The Swartz series consists of fine-textured, imperfectly drained soils on the upland plateau west of Prineville. These soils occupy basins that have no outlets. They developed in material that weathered from pumice and volcanic ash and in mixed sediments that washed into the basins. The plant cover is made up of silver sagebrush, annual grasses, and a small amount of rabbitbrush.

The surface layer is gray to light-gray silt loam, loam, or silty clay loam 4 to 10 inches thick. This layer tends to seal up when wet and cracks as it dries. In many places water stands on the surface after a rain.

Underlying the surface layer is a subsoil of grayish-brown or light brownish-gray clay or silty clay that is neutral or mildly alkaline. The subsoil shrinks when it dries and swells into a massive, tightly sealed layer when wet. Water enters this layer very slowly, and roots penetrate it, mainly in cracks, to a depth of about 18 inches. The lower part of the subsoil is grayish-brown clay or silty clay. The substratum is grayish-brown to light yellowish-brown clay or silty clay.

Swartz soils are used for grazing.

**Swartz silt loam** (Sw).—More than half of this soil occurs on the plateau in the vicinity of the Prineville Airport, and the rest is near Huston Lake and on the plateau west of the Dry River. The soil commonly forms circular or oblong basins that have no outlet. Most areas range from 5 to 40 acres in size, but an area near the airport is larger than 100 acres. Slopes are generally less than 2 percent, though a few small areas have slopes of 4 or 5 percent. In many places the soil is surrounded by Redmond soils.

Representative profile:

0 to 5 inches, gray to light-gray silt loam; soft or slightly hard; slightly acid or neutral.
5 to 32 inches, grayish-brown clay or silty clay; hard; neutral or mildly alkaline.
32 to 60 inches, grayish-brown to dark grayish-brown clay or silty clay; hard when dry, sticky when wet; mildly alkaline.

In areas near Huston Lake, this soil is wetter than in other areas, and its subsoil is darker, mottled, and less clayey. Included in areas mapped as this soil are areas that have a silty clay loam surface layer.

This soil has very slow runoff, and there is little or no erosion hazard. Permeability is slow. The moisture-holding capacity and fertility are low. Root growth is shallow to moderately deep. Irrigating the soil is very easy, but working it is slightly difficult to very difficult.

This soil is moderately well suited to all crops grown locally, but included areas that have a silty clay loam surface layer are poorly suited to potatoes. Most of the soil is in uses other than cultivated crops. Material from the subsoil is used for sealing ponds. *Capability unit IVw-1*

## Veazie Series

The Veazie series consists of moderately dark colored, well-drained or somewhat excessively drained soils on bottom land along Ochoco, Mill, McKay, and Veazie Creeks. These soils formed in sediments that washed from soils derived from several kinds of rocks, chiefly basalt. The original vegetation was mainly grasses, and there were a few willows along the stream channels.

Veazie soils have a surface layer of neutral, dark-gray loam, gravelly loam, or gravelly sandy loam 6 to 12 inches thick. The subsoil is similar but is lighter colored and browner. Below a depth of 15 to 20 inches is a layer of sand and silt that is underlain, at a depth of 18 to 40 inches, by very gravelly or sandy material similar to riverwash.

The Veazie soils are used for irrigated hay and pasture.

**Veazie loam** (Va).—Most of this nearly level soil occurs along McKay and Ochoco Creeks. Many of the small areas are long and narrow, and they parallel the stream channel. Some areas along McKay Creek are somewhat oblong. Slopes generally range from 0 to 2 percent, but about 10 percent of the acreage has slopes of 2 to 6 percent. In many places this soil is flooded for short periods in spring.

Representative profile:

0 to 8 inches, dark-gray loam; soft; neutral.
8 to 24 inches, grayish-brown, stratified loam, silt loam, and very fine sandy loam; slightly hard; neutral.
24 inches +, grayish-brown very gravelly sand; loose; neutral.

The depth to gravel or sand ranges from 20 to 40 inches.

This well-drained soil has very slow runoff, is moderately permeable, and is subject to only slight erosion. The moisture-holding capacity and fertility are moderate. Roots grow to a moderate depth. The soil is very easy to irrigate and to work.

Except along McKay Creek where frost is not a hazard, this soil is not suited to potatoes. It is best suited to irrigated hay and pasture. *Capability unit IIIs-2*

**Veazie loam, shallow** (Vb).—Most areas of this nearly level soil range from 5 to 15 acres in size, and many of them are long and narrow. The soil generally is flooded for short periods in spring.

In this soil the depth to very gravelly or sandy material is 18 to 20 inches, and the loam surface layer and subsoil are gravelly in a few areas. Otherwise the soil is like Veazie loam.

This soil is somewhat excessively drained. It has very slow runoff and moderate permeability, and it is only slightly susceptible to erosion. The moisture-holding capacity and fertility are low. Root growth is shallow. The soil is very easy to irrigate and to work.

Because of the frost hazard, this soil is poorly suited to potatoes. It is best suited to irrigated hay and pasture. *Capability unit IIIs-2*

**Veazie gravelly loam** (Vg).—This soil is mainly along Mill Creek and Ochoco Creek. In most places it occurs in areas of 5 to 15 acres that are long and narrow and are parallel to the stream channel. The soil is commonly flooded for short periods in spring.

Except for its gravelly surface layer and its 24- to 30-inch depth to very gravelly and sandy material, this soil is similar to Veazie loam. About 10 percent of the acreage is on alluvial fans that have slopes of 2 to 12 percent. Included in areas mapped as this soil are a few areas that are gravelly or cobbly sandy loam throughout the profile.

This soil is well drained and moderately permeable. It has very slow runoff and is only slightly susceptible to erosion. Its moisture-holding capacity and fertility are low to moderate. Roots penetrate to a moderate depth. The soil is very easily irrigated and can be worked with little difficulty.

This soil is best suited to irrigated hay and pasture. It is poorly suited to potatoes because it occurs in areas where frost is a hazard. *Capability unit IIIs-2*

**Veazie-Riverwash complex** (Vr).—This complex occurs along the channels of streams, chiefly Mill Creek and Ochoco Creek, and is made up of Veazie loam and Riverwash that are closely intermingled because of the many channels cut during spring floods. About 60 percent of the complex is Veazie loam, and the rest is Riverwash. Although some areas are as small as 5 acres, most of the acreage is in several areas of 50 acres or more that are 150 to 400 feet wide and ½ to 1 mile or more long.

The Veazie soil is suited to hay and pasture, but its use is limited by channels and areas of Riverwash. *Veazie loam: capability unit IIIs-2; Riverwash: capability unit VIIIs-1*

# *Formation, Classification, and Morphology of Soils* [2]

This section has five main parts. The first explains the five factors of soil formation; the second discusses genetic relationships and processes; the third classifies the soils by orders and great soil groups; the fourth gives detailed profile descriptions of representative soils in the Prineville Area; and the fifth provides laboratory data on selected soil profiles.

## Factors of Soil Formation

Five factors have determined the formation of soils in the Prineville Area. These factors are (1) climate, (2) organisms, chiefly vegetation, (3) parent material, (4) relief, or lay of the land, and (5) time. Except for time, each of these consists of many individual factors. Climate, for example, is made up of temperature, the amount

[2] E. G. Knox, associate professor of soils, Oregon State University, prepared this section.

of sunshine, the amount and distribution of rainfall, and so on. Moreover, one group of factors influences another. Vegetation is largely, though not entirely, controlled by climate. The degree of horizon development, which reflects the age of a soil, depends partly on relief. Characteristics of any soil are determined by and can be explained by the interaction of these five factors. Table 5 shows the great soil group, selected characteristics, and parent material of each soil series in the Prineville Area.

### *Climate*

The climate of the Prineville Area is semiarid, and most of the annual precipitation occurs in winter. Climatic data for the Area are given in the section "Facts About Crook County."

Climate influences the formation of soils directly and through control of the kind and amount of native vegetation. In this Area three direct influences are most important. First, temperature in winter is so low that the soils are frozen for a long period. During this period the intake of moisture and many processes of soil formation are completely stopped. Second, the total precipitation and its seasonal distribution are such that most soils thoroughly dry out each summer. Third, the intake of precipitation is confined to a fairly short period, and consequently the depth of leaching is great compared to the amount of precipitation.

### *Organisms*

Although rodents and ants mix materials of soil horizons and thus retard their development, plants are much more important than animals in determining the formation of soils. In general, there are two climate-vegetation zones in the Area. In the lower rainfall zone, or the zone of Brown soils, the depth and the amount of leaching are less than in the higher rainfall zone, or the zone of Chestnut soils.

In well-drained locations throughout the zone of lower rainfall, the original vegetation was chiefly bluebunch wheatgrass and Sandberg bluegrass. Big sagebrush made up part of the plant cover, but there was no Idaho fescue or bitterbrush. In the zone of higher rainfall, the vegetation consisted of a dense stand of bluebunch wheatgrass and some Sandberg bluegrass, Idaho fescue, big sagebrush, and bitterbrush.

Plants in these two kinds of cover supplied different amounts of organic matter to the soils on which they grew. The Chestnut soils received the larger amounts and have a thicker, darker A horizon. Laboratory analysis shows that they also have a higher organic-matter con-

TABLE 5.—*Soil series of the Prineville Area and their classification, selected characteristics, and parent material*

| Soil series | Great soil group | Degree of B horizon development | Hardpan | Natural drainage | Parent material |
|---|---|---|---|---|---|
| Agency | Brown | Moderate | None | Good | Material weathered from pumice, sandstone, and basalt. |
| Ayres | Brown | Moderate | Indurated | Good | Fan alluvium from rhyolite and pumice. |
| Bakeoven | Brown | Moderate | None | Good | Material weathered from basalt. |
| Boyce | Humic Gley | None | None | Poor or very poor | Flood-plain alluvium from mixed rocks. |
| Courtrock | Brown | None | None | Good | Fan alluvium from basalt and tuff. |
| Crooked | Alluvial | None | Strong | Imperfect | Flood-plain alluvium from pumice. |
| Day | Grumusol | None | None | Good | Material weathered from tuff. |
| Deschutes | Brown | None | None | Good or somewhat excessive. | Material weathered from pumice. |
| Elmore | Chestnut | Moderate | None | Good | Material weathered from rhyolite. |
| Forester | Alluvial | None | None | Imperfect | Flood-plain alluvium from pumice. |
| Gem | Chestnut | Moderate | None | Good | Material weathered from basalt. |
| Lamonta | Brown | Strong | Indurated | Good | Fan alluvium from rhyolite. |
| Lookout | Brown | Strong | Strong | Good | Colluvium from basalt. |
| Metolius | Alluvial | None | None | Good or somewhat excessive. | Flood-plain alluvium from pumice. |
| Ochoco | Brown | Moderate | Weak to strong | Good | Terrace and fan alluvium from basalt. |
| Ontko | Humic Gley | None | None | Poor or very poor | Flood-plain alluvium from mixed rocks. |
| Polly | Chestnut | Moderate | None | Good | Fan alluvium from basalt and tuff. |
| Powder | Alluvial | None | None | Good or moderately good. | Flood-plain alluvium from mixed rocks. |
| Prineville | Brown | None | Weak to strong | Good | Terrace and fan alluvium from basalt. |
| Redmond | Brown | Moderate | None | Good | Material weathered from pumice. |
| Salisbury | Chestnut | Strong | Strong or indurated. | Good | Fan alluvium from basalt. |
| Searles | Brown | Moderate | Strong or indurated. | Good | Material weathered from tuff and rhyolite. |
| Slayton | Lithosol | None | None | Good | Material weathered from sandy tuff. |
| Stearns | Solonetz | Moderate | Weak | Imperfect | Flood-plain alluvium from mixed rocks. |
| Steiger | Regosol | None | None | Good | Fan alluvium from volcanic ash. |
| Swartz | Soloth | Moderate | None | Imperfect | Material weathered from pumice and sorted by water. |
| Veazie | Alluvial | None | None | Good or somewhat excessive. | Flood-plain alluvium from mixed rocks. |

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tent and a higher carbon-nitrogen ratio. For example, in an Elmore soil sampled on a north slope, the average content of organic matter was 4.1 percent, and the average carbon-nitrogen ratio was 13.2 in the A1 horizon. In contrast, a Searles soil was sampled on a south slope, and this Brown soil had an average organic-matter content of 1.7 percent and an average carbon-nitrogen ratio of 10.8.

Areas that are not well drained have a cover of native plants that differs from the two types common in well-drained areas. On the flood plain of streams, grasses, sedges, and rushes grow in various combinations where the soils are wet for long periods but are not affected by alkali. This vegetation supplies an abundance of organic matter, and the soils have a thick, dark-colored A horizon. Silver sagebrush is dominant in places that accumulate water but are not wet for long periods. Such areas are the small depressions of Swartz soil on the upland plateau west of Prineville. Greasewood and saltgrass are the principal plants in wet areas affected by alkali.

### *Parent material*

The soils of the Prineville Area have formed from five kinds of parent material: (1) material resulting from the weathering of bedrock and local movement on sloping uplands and plateaus, (2) alluvium deposited in alluvial fans and ranging widely in size of particles, (3) gravelly or sandy alluvium on terraces, (4) pumice on uplands from geologically recent volcanic explosions, and (5) stream alluvium on flood plains and low benches.

The size of particles, mineralogy, and thickness of the parent material have greatly influenced the nature of the soils. Some soil characteristics are inherited directly from the parent material. For example, the materials on uplands have produced soils that are generally shallow to bedrock and stony, except for those that overlie the soft, clayey rocks of the John Day and Clarno formations (*2*). Soils formed in material on alluvial fans and terraces generally are somewhat gravelly or cobbly.

Some soils have inherited their light weight and sandy characteristics directly from pumice. The Deschutes and Redmond soils were derived from pumice in place; the Steiger soils developed in pumicy material redeposited in alluvial fans; and the Metolius, Crooked, and Forester soils developed in pumicy material on flood plains. Except for the Stearns soils, other soils developed in flood-plain alluvium inherited their texture from parent material.

Other characteristics of soils are influenced less directly by parent material. The cracking and churning in the Day soils are the result of a high clay content and the mineralogy of the tuff materials from which the soils formed. Various proportions of tuff and basalt from the Clarno formation may have caused the difference in texture between the Courtrock and the Polly soils. In addition, the difference in textural development between the Prineville and the Ochoco soils, as shown by their clay content (see table 11, p. 78), may be caused by a difference in parent material. Other influences of parent material are less evident and are described in the subsection "Descriptions of Soil Profiles."

### *Relief*

Relief is strongly related to the origin of parent material. Thus, the materials weathered from bedrock and moved locally are on the nearly level to very steep slopes of hills and upland plateaus. Soils from material on terraces are nearly level, except those on escarpments and in drainageways cut into the terraces. Soils from recent alluvium are level except in places where stream channels occur, and they may have a water table that is high enough to influence soil development.

Aspect, or the direction a slope faces, is an important part of relief. It strongly influences the exposure of soils to the sun and the disposition of precipitation. South-facing slopes are warmer and dryer than north-facing slopes, and this difference is equivalent to an actual difference in rainfall. Some hills have a plant cover that is typical of Brown soils on south slopes and of Chestnut soils on north slopes. Laboratory analysis indicates that soils on south slopes differ from those on north slopes in having a lower content of organic matter and a lower carbon-nitrogen ratio, and they are less leached, as shown by the degree of base saturation. For example, Elmore very stony loam occurs on north slopes and has an average base saturation of about 80 percent in the A horizon, but a Searles soil that occurs on south slopes has an average base saturation of about 85 percent in the A horizon.

If other factors are constant, steep soils tend to have less distinct horizons than more gently sloping soils, probably because geologic erosion is faster on steep slopes and less water is absorbed for use in soil development.

Natural drainage is influenced by relief and parent material. Well-drained soils are not wet for any significant period of time, but poorly drained soils are wet for long periods. Natural drainage is an important soil characteristic in itself, and it also has an indirect effect on the kind and amount of vegetation. Soils can be made saline or sodic through the influence of ground water. Most soils in the Prineville Area are well drained, and the wetter soils occur only on flood plains and in depressions on the upland plateau.

### *Time*

The formation of soil from parent material takes time. If factors other than time are equal, young soils have less distinct horizons than old soils.

Most soils that formed in upland materials are old enough to have moderately or strongly developed horizons. In this Area, however, some of these soils are weakly developed. Day clay is a weakly developed soil, presumably because it was so dominated by clay inherited from the parent material that not much development was possible. It is presumed that geologic erosion was responsible for the weak development of the Slayton soils.

Soils that formed on alluvial fans vary in age and in degree of development. Most fans consist of material that was not deposited uniformly but was shifted from place to place. In soils that developed in fan alluvium derived from similar parent rock, it is not known how much of the difference in degree of development can be attributed to a difference in age of the alluvium and how much to difference in texture and mineralogy of it.

Soils that formed on terraces are younger and less strongly developed than most soils that formed on uplands. The degree of development varies in these soils on terraces, probably because of differences in texture of the terrace material.

The pumice in the Prineville Area was laid down in geologically recent times, and the soils that formed in it are not strongly developed. The Deschutes and the Redmond soils differ in their degree of development, but the difference is probably not a result of a difference in age. It may be caused by a difference in the material underlying the pumice or a difference in the amount of water available for weathering because of unlike relief. Although the Swartz soils developed partly in material that weathered from pumice, their development is stronger than that of the Deschutes and Redmond soils, likely because of a difference in the availability of water or a difference in texture caused by water sorting the parent material of the Swartz soils.

Soils that formed in recent alluvium are young and generally are weakly developed. Of these, the Stearns soils are the most strongly developed. They occur on an older bench and have a high percentage of exchangeable sodium, which can speed the process of soil development. The Crooked and Forester soils also occur on older benches but are weakly developed, though they have a strongly to weakly developed hardpan. The reason for this difference is not known. Other soils from recent alluvium are weakly developed.

TABLE 6.—*Soils of the Prineville Area arranged by parent material, parent rock, and degree of development*

| Dominant parent material and parent rock | Degree of development [1] | | |
|---|---|---|---|
| | Textural B horizon weak or none | Textural B horizon moderate | Textural B horizon strong |
| Upland material: | | | |
| Basalt | | Bakeoven, Gem. | Lookout. |
| Rhyolite | | Searles, Elmore. | |
| Tuff | Day | Searles | |
| Sandy tuff | Slayton | | |
| Sedimentary beds. | | Agency | |
| Pumice, mostly in place but some windlaid. | Deschutes | Redmond | |
| Pumice, sorted by water. | | Swartz | |
| Alluvial-fan material: | | | |
| Basalt | | | Salisbury. |
| Rhyolite | | Ayres | Lamonta. |
| Mixed basalt and tuff. | Courtrock | Polly | |
| Pumice | Steiger | | |
| Alluvial-terrace material: | | | |
| Basaltic mixture | Prineville | Ochoco | |
| Flood-plain alluvium: | | | |
| Pumice | Crooked, Forester Metolius. | | |
| Mixed | Boyce, Powder, Ontko, Veazie. | Stearns | |

[1] The degree of development is determined by time, relief, and parent material.

## Genetic Relationships and Processes

The relationships of soil series in the Prineville Area to the factors of soil formation, and to one another, are shown in tables 6, 7, 8, and 9. Only the most obvious relationships can be expressed in these tables. Detailed information about the soils is given in the subsections "Descriptions of Soil Profiles" and "Laboratory Data" and in the section "Descriptions of Soils."

TABLE 7.—*Selected soil series arranged according to sources of parent material and their geologic formations*

| Geologic formation and type of rock | Parent material | |
|---|---|---|
| | Material on uplands | Material on alluvial fans |
| Clarno: | | |
| Tuff | Searles | |
| Sandy tuff | Slayton | |
| Basalt | Gem | |
| Rhyolite | Searles, Elmore | Ayres, Lamonta. |
| Mixed basalt and tuff | | Courtrock, Polly. |
| John Day | Day | |
| Columbia River basalt | Lookout, Gem | Salisbury. |
| Dalles: | | |
| Sedimentary beds | Agency | |
| Basalt | Bakeoven | |
| Intracanyon | Bakeoven | |

Soils in this Area have formed from parent material through the interaction of many physical, chemical, and biological processes. The same general processes have acted on the parent material of all the soils in the Area and on the parent material of all the soils in the world. Differences in soils are the result of differences in parent material and in the relative effects of the various processes controlled by the other factors of soil formation.

Most of our information about the genetic processes is inferred from our knowledge of the results of these processes. In soils of the Prineville Area, the most important features produced by genetic processes are (1) an A horizon that has an accumulation of organic matter, (2) a B horizon that has an accumulation of silicate clay, (3) a hardpan, presumably cemented by alkali-soluble material, in well-drained and imperfectly drained soils, (4) soft consistence and platy structure in the A horizon of some soils, (5) calcium carbonate in the lower horizons of some soils and fairly high base saturation, and (6) high sodium saturation in some soils. Each of these features is discussed in the paragraphs that follow.

### *The A horizon*

The amount of organic matter in the A horizon is a balance between additions, mainly from higher plants, and losses, mainly from oxidation, caused by decomposition and the return of oxidation products to the atmosphere. In Chestnut soils the balance between additions and losses is at a higher level of organic matter than in Brown soils, presumably because of differences in kind

TABLE 8.—*Relationship of some soils and their parent material to native vegetation and average annual precipitation*

| Dominant parent material and parent rock | Soils formed under— | |
|---|---|---|
| | Big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass where precipitation is 8 to 10 inches | Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and bitterbrush where precipitation is 11 to 13 inches |
| Material on uplands: | | |
| Basalt | Bakeoven, Lookout. | Gem. |
| Rhyolite | Searles | Elmore. |
| Tuff | Searles | |
| Sandy tuff | Slayton | |
| Sedimentary rocks | Agency | |
| Pumice, windlaid | Deschutes, Redmond. | |
| Material on alluvial fans: | | |
| Basalt | | Salisbury. |
| Rhyolite | Ayres, Lamonta | |
| Mixed rocks, chiefly basalt and tuff. | Courtrock | Polly. |
| Material on alluvial terraces from a basaltic mixture. | Prineville, Ochoco | |

and amount of plant cover. (See table 11, p. 78, for laboratory analyses of an Elmore soil and of Ayres, Ochoco, Prineville, and Searles soils.)

Wet soils affected by alkali have a low organic-matter content because the plants tolerant of alkali do not supply much organic matter. (See laboratory analysis for the Crooked soils in table 11.) In imperfectly drained and poorly drained soils that are not affected by alkali, the organic-matter content is high because the plants make large additions and wetness retards oxidation. Laboratory data for the Swartz soil (see table 11) show that a fairly high level of organic matter can be built up even by silver sagebrush, but the Boyce and Ontko soils have a significantly higher organic-matter content.

### *The B horizon*

Laboratory data on the content of clay indicate that the Ayres, Lamonta, Ochoco, Searles, Stearns, and Swartz are among the soils that have a textural B horizon. An accumulation of clay forms a textural B horizon if (1) the relative concentration of clay in the horizon increases because other constituents are removed, (2) the formation of clay from primary minerals is greater in the B horizon that in other horizons, or (3) clay or clay constituents are transferred into the B horizon. The relative importance of these alternatives is not known.

The soils having the most strongly developed textural B horizons are on upland hills and on alluvial fans. Soils that developed in material from basalt or rhyolite appear to be very old. Basalt and rhyolite contain no clay and, in soils derived from them, it is likely that the clay formed from primary minerals at some stage in soil formation. Consequently, the strong development of the B horizon in these soils is best explained by their great age.

The Polly soils developed from parent material that contained fragments of tuff rock. In these soils the high clay content may be the result of a fairly simple breakdown in tuff fragments. However, the Courtrock soils have similar parent material but are not strongly developed. Whether the textural B horizon in the soils of these two series differs in degree of development because of small differences in parent material or differences in age is not known.

Most other soils that occur in upland areas but lack a strong textural B horizon likely are younger than the Polly and Courtrock soils. The Day soils have no textural B horizon, though they are old and developed from clayey parent material. These soils, however, have a high content of clay that swells when wet and shrinks as it dries—a process that churns and mixes the soil material and thus prevents formation of a B horizon. In the Steiger soils a textural B horizon has not developed, because the parent material of volcanic ash is very young.

The Prineville and the Ochoco soils developed side by side on the same terrace, but no reason is evident for a difference in genetic processes that formed them. Presumably there were small differences in parent material that caused the difference in degree of textural development.

The Deschutes soils are weakly developed because they are from young parent material. The Redmond and probably the Swartz soils are from pumice of the same age, but the Swartz soils have a higher content of clay, possibly because a greater amount of moisture was available for weathering. Sorting of the pumice by water may have provided finer textured parent material for the Swartz soils.

All soils on flood plains except the Stearns show little if any development of a textural B horizon. These soils are too young for the movement of clay through genetic

TABLE 9.—*Relation of parent material and natural drainage to soils that formed in weathered pumice or in flood-plain alluvium*

| Parent material | Natural drainage | | |
|---|---|---|---|
| | Somewhat excessive to moderately good | Imperfect | Poor or very poor |
| Pumice: | | | |
| Mostly in place | Deschutes, Redmond. | | |
| Sorted by water | | Swartz | |
| Flood-plain alluvium: | | | |
| On older benches | | Crooked, Forester, Stearns. | |
| On younger benches. | Metolius, Powder, Veazie. | | Boyce, Ontko. |

processes. The Stearns soil occurs on an older bench and has high sodium saturation, which hastens the transfer of clay from one horizon to another.

### Hardpan

A hardpan consists of siliceous material that has accumulated in a horizon more or less well defined. In well-drained soils the cementing material occurs in rounded forms that hang on the bottom of rock fragments. This indicates that the material precipitated from solution and accumulated through downward movement, and it implies that siliceous material was brought down in solution from upper horizons. The present pH values in these soils are not high enough to account for much solution of silica, and it seems almost certain that at least some well-drained soils with hardpan have always been well drained but have never had very high pH values. For this reason, the processes by which these pans have formed are not known.

Soils that have the most strongly developed hardpan are those that have a strongly developed textural B horizon or those, such as the Ayres soils, that formed mainly from material other than pumice but were covered by a layer of pumice, which can be a ready source of siliceous material. Imperfectly drained soils with hardpan, such as the Crooked and Forester soils, have high pH values. In these soils the configuration of the cementing material does not suggest that the material moved downward, and the pans may have been formed by the precipitation of siliceous material from ground water at the level of the water table.

### Consistence and structure

In well-drained soils of the Prineville Area, the consistence and structure in the A horizon differ strikingly from those of some soils in other areas that have an A horizon of comparable texture and organic-matter content. The soft consistence and platy structure in soils of the Area likely are related to the nature and distribution of the organic matter and to the processes of freezing and thawing and of wetting and drying.

### Calcium carbonate and base saturation

Leaching has been active in soils of the Area, as indicated by the absence of calcium carbonate and less than complete base saturation in the upper horizons. That leaching is far from complete, however, is shown by the presence of lime and fairly high base saturation in the lower horizons. Precipitation falls mostly in winter in this Area and, consequently, the depth of leaching is greater than the average annual precipitation might indicate. In general, Chestnut soils are more strongly leached than Brown soils.

### Sodium saturation

Only the soils with a high water table have high sodium saturation. The sodium probably is supplied from the ground water and is exchanged for other cations in these soils.

## Classification of Soils

Soil classification is intended to help us understand relationships and remember characteristics. The system used to classify the soils in the Prineville Area is explained in the U.S. Department of Agriculture Yearbook for 1938 (*15*). Since that year, our knowledge of the soils has increased and, as a result, a few changes have been made in the system.

In the 1938 system of soil classification, soils are placed in four categories. From the broadest category to the narrowest, these are the order, great soil group, series, and type.

Soils in the broadest category are classified in three soil orders—zonal, intrazonal, and azonal. Each of these orders consists of a number of great soil groups, only some of which are represented in this Area. The section "How Soils Are Mapped and Classified" describes how soils are classified in the lower categories—the soil series and soil type.

The classification of the soils in the Prineville Area by orders and great soil groups is discussed in this subsection and is shown in table 10.

TABLE 10.—*Classification of soil series by orders and great soil groups*

| Great soil group and series | Remarks |
|---|---|
| **ZONAL** | |
| Brown soils: | |
| Ayres, Lamonta, Lookout, Ochoco. | Textural B horizon; hardpan. |
| Agency, Bakeoven, Redmond, Searles. | Textural B horizon; no hardpan. |
| Prineville | No textural B horizon; hardpan. |
| Courtrock, Deschutes | No textural B horizon; no hardpan. |
| Chestnut soils: | |
| Salisbury | Textural B horizon; hardpan. |
| Elmore, Gem, Polly | Textural B horizon; no hardpan. |
| **INTRAZONAL** | |
| Humic Gley soils: | |
| Boyce. | |
| Ontko. | |
| Soloth soils: | |
| Swartz. | |
| Solonetz soils: | |
| Stearns. | |
| Grumusols: | |
| Day. | |
| **AZONAL** | |
| Regosols: | |
| Steiger. | |
| Lithosols: | |
| Slayton. | |
| Alluvial soils: | |
| Crooked, Forester | Strongly sodic. |
| Metolius, Powder, Veazie | Typical. |

### Zonal soils

Zonal soils have developed through soil-forming processes dominated by climate and vegetation. In the Prineville Area the great soil groups in the zonal order are the Brown soils and the Chestnut soils.

#### BROWN SOILS

Brown soils have a surface horizon that is platy, soft or slightly hard, and light brownish gray or lighter when dry. These soils developed under bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and other native plants in a semiarid climate (*14*). Base saturation is high, and calcium carbonate is common in the lower horizons. A B horizon is present, but it may be weakly developed. Some of the Brown soils have a hardpan below the B horizon.

The Brown great soil group can be divided into four subgroups on the basis of the presence or absence of a textural B horizon and of a hardpan. In the first subgroup are soils that have a moderately or strongly developed textural B horizon and a strongly developed hardpan. Soils in this subgroup are the Ayres, Lamonta, Lookout, and Ochoco soils. The Ochoco sandy loam described in the subsection "Description of Soil Profiles" is typical of Brown soils that have a hardpan.

The second subgroup consists of soils that have a textural B horizon but have no hardpan or only an intermittent or weakly developed one. Soils in this subgroup are the Agency, Bakeoven, Redmond, and Searles soils.

In soils of the third and fourth subgroups, a textural B horizon is missing or is only weakly developed. These soils, however, have a horizon that resembles a textural B horizon but has little or no discernable accumulation of clay. In the third subgroup are the Prineville soils, which have a hardpan. In the fourth subgroup are the Courtrock and Deschutes soils, which do not have a hardpan. The soils of the third and fourth subgroups have some characteristics of Regosols.

#### CHESTNUT SOILS

Chestnut soils have a surface horizon that is platy, grayish brown, and soft or slightly hard when dry, and very dark grayish brown or darker when moist. These soils developed under a dense stand of bluebunch wheatgrass and a lesser amount of Sandberg bluegrass, Idaho fescue, big sagebrush, and bitterbrush. Rainfall is slightly higher than in areas of Brown soils.

In the Prineville Area the Chestnut soils are the Salisbury, Elmore, Gem, and Polly soils. These soils have a textural B horizon, and only the Salisbury soils have a hardpan. In general, base saturation is not quite so high in Chestnut soils as it is in Brown soils. In places lime occurs in the lower horizons. The Elmore soil described in the subsection "Descriptions of Soil Profiles" is typical of Chestnut soils.

### Intrazonal soils

Intrazonal soils have developed through soil-forming processes dominated by relief or parent material. In this Area the great soil groups in the intrazonal order are the Humic Gley soils, the Soloth soils, the Solonetz soils, and the Grumusols.

#### HUMIC GLEY SOILS

Humic Gley soils have a dark-colored surface horizon and gray or mottled lower horizons. They are naturally wet, and wet conditions have dominated in their development. In the Prineville Area the Humic Gley soils are in the Boyce and Ontko series.

#### SOLOTH SOILS

Soloth soils have a thin, light-colored surface horizon over a gray, leached horizon that overlies darker, finer textured horizons. These soils formed under shrubs, grasses, or mixed grasses and trees, mainly in a semiarid or subhumid climate. They are naturally wet during part of the year. In the Prineville Area the only Soloth soils are in the Swartz series. The Swartz soils have an A1, an A2, and a textural B horizon. Laboratory analysis of their clay content shows that they grade toward the Planosol great soil group, but their content of exchangeable sodium and magnesium indicates that they are best classified as Soloth soils.

#### SOLONETZ SOILS

Solonetz soils have a friable surface horizon of variable thickness that is underlain by a textural B horizon of prismatic or columnar structure. These soils ordinarily contain a high percentage of sodium. They formed under grasses or shrubs, mainly in a subhumid or semiarid climate. In this Area the only Solonetz soils are in the Stearns series. The Stearns soils have a hardpan.

#### GRUMUSOLS

Grumusols are soils that have a fairly high content of clay and are marked by signs of local soil movement resulting from shrinking and swelling as the soils wet and dry. The horizons are churned or mixed because material from the upper horizons falls into deep, wide cracks when the soils are dry and, when they again are wet, material from the lower horizons is pushed upward as the cracks close. In this Area the Day soils show the effects of churning and are classified as Grumusols.

### Azonal soils

Azonal soils have no development, or only weak development, of a profile, mainly because they are young soils. In the Prineville Area the great soil groups in the azonal order are Regosols, Lithosols, and Alluvial soils.

#### REGOSOLS

Regosols have a weakly developed A horizon but have no B or hardpan horizon. They developed from unconsolidated material other than recent alluvium. In this Area the only Regosols are in the Steiger series. If the definition of Regosols were broadened to include soils with hardpan, the Prineville soils could be classified Regosols rather than Brown soils.

#### LITHOSOLS

Lithosols have no clearly expressed soil morphology and consist of a freshly and imperfectly weathered mass of rock fragments. In most places they are shallow to bedrock. The Slayton soils are the only Lithosols in the Prineville Area.

ALLUVIAL SOILS

Alluvial soils consist of transported and recently deposited material. They are characterized by a weak modification, or no modification, of the original material by soil-forming processes. This great soil group is represented in the Prineville Area by the Metolius, Powder, Veazie, Crooked, and Forester soils.

The Metolius, Powder, and Veazie soils are typical Alluvial soils that are not strongly sodic and have a weakly developed A horizon over undifferentiated alluvial material.

The Crooked and Forester soils are strongly affected by alkali and have features more strongly expressed than typical. This is especially true of the Crooked soils, which have a hardpan. Nevertheless, the soils in these two series are classified as Alluvial soils.

## Descriptions of Soil Profiles

Following are detailed descriptions of representative profiles of the different soil series in the Prineville Area. Soils having a profile number (for example, No. S55-Oreg.-7-3) are those for which laboratory data are given in the table that begins on p. 78.

Technical terms used in describing the soils are defined in the Soil Survey Manual (*13*); some of these terms also are defined in the Glossary at the end of this report. Letters and numerals on the left designate the horizons in each profile. Combinations of letters and numbers in parentheses, such as (10YR 5/4), are Munsell notations of hue, value, and chroma. These notations are more precise than descriptive names of color, which also are given.

AGENCY SERIES

Profile of Agency very stony sandy loam under native vegetation, located in the SE¼SW¼SW¼ sec. 6, T. 15 S., R. 16 E.:

A1—0 to 6 inches, grayish-brown (10YR 5/2) very stony sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular and weak, thin, platy structure; soft or slightly hard when dry, friable when moist, very slightly sticky and nonplastic when wet; roots common; many fine pores; neutral (pH 6.8); clear, wavy boundary.

A3—6 to 11 inches, light brownish-gray (10YR 6/2) very stony sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure crushing to weak, very fine, granular structure; soft or slightly hard when dry, friable when moist, very slightly sticky and nonplastic when wet; roots common; fine and medium pores are common; neutral (pH 7.0); clear, wavy boundary.

B1t—11 to 15 inches, pale-brown (10YR 6/3) very stony loam or light clay loam, dark brown (10YR 4/3) when moist; weak to moderate, medium and fine, blocky structure; hard when dry, firm when moist, sticky and slightly plastic when wet; common, fine and medium, tubular pores; few to common roots; thin, patchy clay films; neutral or mildly alkaline (ph 7.3 to 7.6); clear, wavy boundary.

B2t—15 to 22 inches, brown (10YR 5/3) very stony clay loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; common roots; few, fine and medium, tubular pores; moderately thick, continuous clay films on peds and in pores; moderate number of basalt fragments, rounded pebbles, and cobbles; calcareous in lower part; mildly alkaline (pH 7.6 to 8.0); gradual to clear, wavy boundary.

C1ca—22 to 36 inches, light brownish-gray (10YR 6/2) very gravelly and stony sandy loam to sandy clay loam, dark grayish brown (10YR 4/2) when moist; massive (structureless); slightly hard or hard when dry, firm when moist, slightly sticky and very slightly plastic when wet; few roots; few, fine, discontinuous, tubular pores; moderately alkaline (pH 8.2); calcareous; clear to gradual boundary.

IIC—36 inches +, light brownish-gray (10YR 6/2), poorly sorted, stratified sand, gravel, and stones that grade to sandstone or basalt.

AYRES SERIES

Profile of Ayres gravelly sandy loam (profile No. S55-Oreg.-7-3), located in the SE¼SE¼SE¼ sec. 19, T. 15 S., R. 15 E.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure breaking to weak, fine, granular structure or single grain; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots; porous; moderate content of pale-brown pumice sand ranging from fine to medium in size; numerous grayish and reddish, angular and subangular pebbles; neutral (pH 6.8); clear, wavy boundary.

A3—5 to 8 inches, light brownish-gray (10YR 6/2) gravelly fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; moderately porous; the pebbles increase in number and size with depth; moderate to low pumice content; neutral (pH 6.8); clear, irregular boundary.

B2t—8 to 14 inches, brown (10YR 5/3) gravelly clay loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure breaking to moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; roots concentrated between peds; few pores; many channery fragments that are partly oriented and have flat surfaces generally horizontal; thin, nearly continuous, slightly darker clay films on peds; little or no pumice; calcium carbonate on lower surface of cobbles; neutral (pH 7.1); abrupt boundary.

C1sim—14 to 29 inches, pale-brown (10YR 6/3) gravelly and cobbly, indurated hardpan; lenses of brown silica appearing very dense, glazed, and opalized; carbonates on the lower side of cobbles; neutral.

C2—29 to 50 inches +, light brownish-gray (10YR 6/2), stratified very gravelly and cobbly loam or sandy loam that contains reddish and grayish pebbles and cobbles of rhyolite or dacite; massive (structureless); lime in seams.

BAKEOVEN SERIES

Profile of Bakeoven very stony loam, 0 to 20 percent slopes, in a range area located in the SE¼SE¼SE¼ sec. 7, T. 15 S., R. 15 E.:

A1—0 to 4 inches, grayish-brown (10YR 5/2) very stony loam, very dark grayish-brown (10YR 3/2) when moist; moderate, thin, platy structure crushing to weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; few to common roots; common, fine, tubular pores in lower 3 inches and many, fine, vesicular pores in upper 1 inch; silt films in vesicles; common, large, basaltic stones throughout this horizon; neutral (pH 6.8); clear, smooth boundary.

B1t—4 to 7 inches, pale-brown (10YR 6/3) very stony light clay loam or heavy loam, dark brown (10YR 4/3) when moist; weak to moderate, medium, platy structure and weak, fine and medium, subangular blocky structure; slightly hard when dry, friable or firm when moist, slightly sticky and slightly plastic when wet; few to common roots; common, fine, tubular pores; thin, patchy clay films along plates and in pores; neutral (pH 6.8); clear, wavy boundary.

B2t—7 to 11 inches, brown (10YR 5/3) very stony clay loam, dark brown (10YR 4/3) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, firm when moist, sticky and plastic when wet; few roots; few, fine, tubular pores; thin, nearly continuous clay films on peds and in pores; neutral (pH 6.8-7.0); abrupt boundary.

R—11 inches +, very dark gray to black, vesicular basalt; commonly lime coated.

### BOYCE SERIES

Profile of Boyce silty clay loam under sod, located in the NE¼SW¼ sec. 5, T. 15 S., R. 16 E.:

A11—0 to 3 inches, pale-brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) when moist; moderate, medium, granular structure grading to weak, thin, platy structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; matted and bound with peaty roots; porous; moderately alkaline; moderately calcareous; abrupt, smooth boundary.

A12g—3 to 7 inches, grayish-brown to gray (2.5Y 5/2 to 5/1) silty clay loam, very dark grayish brown (10YR 3/2) when moist; common, fine and medium, distinct mottles of reddish brown; few, large, distinct areas mottled with dark gray and dark olive gray; moderate, very thin and medium, platy structure; hard when dry, friable when moist, sticky and plastic when wet; abundant roots; common, fine, tubular pores; moderately alkaline (pH 8.0–8.2); moderately calcareous; abrupt, wavy boundary.

A13g—7 to 10 inches, grayish-brown (10YR 5/2) silty clay loam, black (10YR 2/1) when moist; slightly finer in texture than above, with less organic matter and fewer roots; moderate, medium and fine, blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful roots; few, fine, tubular pores; few, dark-gray mottles; moderately alkaline; moderately calcareous; clear, smooth boundary.

AC1g—10 to 15 inches, grayish-brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) when moist; moderate, fine and medium, blocky structure; hard when dry, friable when moist, sticky and plastic when wet; distinctly mottled with common, fine, reddish-brown and yellowish-brown stains and few, distinct, coarse bluish-gray or very dark gray splotches; few roots; few pores and root channels; moderately alkaline; calcareous; clear, smooth boundary.

AC2—15 to 24 inches, grayish-brown (2.5Y 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; massive (structureless) to weak, fine and medium, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few, large, mottled bands or streaks of very dark gray; few roots; very few pores; mildly alkaline; noncalcareous; abrupt, smooth boundary.

C—24 to 31 inches, gray (2.5Y 5/0) sandy loam and sandy clay loam, very dark gray (2.5Y 3/1) when moist; massive (structureless); slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; few roots; porous; numerous worm casts or old root channels filled with material high in content of silt; noncalcareous; mildly alkaline; gradual to abrupt transition to lower strata of gravelly and sandy alluvium.

IIC2—31 inches +, stratified layers of sand and gravel.

### COURTROCK SERIES

Profile of Courtrock sandy loam in a cultivated field located in the NE¼SW¼SW¼ sec. 34, T. 14 S., R. 16 E.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish-brown (10YR 4/2) when moist; weak, thin, platy structure breaking to weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; abundant roots; porous; upper one-half inch has common, fine vesicules or pores, a moderate amount of pale-brown, fine to coarse pumice sand and few to common, reddish pebbles; neutral (pH 6.8); clear, smooth boundary.

B1—8 to 16 inches, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 4/3) when moist; weak, thin and medium, platy structure breaking to weak, fine, granular structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common, fine, tubular pores; few to common, reddish pebbles; moderate amount of pale-brown, fine and medium pumice sand; neutral (pH 6.9); clear, irregular boundary.

B21—16 to 21 inches, pale-brown (10YR 6/3) heavy sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many fine pores; small amount of pumice; neutral; clear to abrupt, wavy boundary.

B22—21 to 30 inches, brown (7.5YR 5/4) heavy sandy loam, dark brown (7.5YR 3/3) when moist; weak, fine and medium, blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many fine pores; an occasional clay film on peds; little pumice; calcium carbonate on under side of pebbles where gravel occurs; mildly alkaline (pH 7.8), mildly calcareous in lower part; clear, irregular boundary.

C1ca—30 to 37 inches, light-brown (7.5YR 6/4) fine gravelly sandy loam or fine gravelly loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common fine pores; moderately alkaline; calcareous; clear, irregular boundary.

C2ca—37 to 50 inches, light-brown (7.5YR 6/3) fine gravelly heavy sandy loam, dark brown (7.5YR 3/3) when moist; massive (structureless); soft or slightly hard when dry, friable or firm when moist, slightly sticky and slightly plastic when wet; much calcium carbonate accumulated but segregated; moderately alkaline; gradual to abrupt boundary.

C3ca—50 to 60 inches, light yellowish-brown (10YR 6/4), stratified sandy loam or gravelly sandy loam, dark yellowish brown (10YR 4/4) when moist; massive (structureless); slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; moderately alkaline (pH 8.2); weakly to moderately calcareous.

### CROOKED SERIES

Profile of Crooked sandy loam (profile No. S55–Oreg.–7–11), located in the NW¼SE¼SW¼ sec. 5, T. 15 S., R. 16 E. (1,600 feet east and 800 feet north of section corner):

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin and medium, platy structure breaking to weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; plentiful roots; pores mainly interstitial; slightly calcareous; pH 9.1; gradual, smooth boundary.

AC—6 to 13 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; very weak, medium, subangular blocky structure; soft when dry, friable when moist, slightly sticky and nonplastic when wet; plentiful roots; pores mainly interstitial; moderately calcareous with disseminated lime; pH 9.0 to 10.0; abrupt boundary.

C1m—13 to 20 inches, light-gray (10YR 7/2), strongly cemented, thick platy hardpan, dark grayish brown (10YR 4/2) when moist; roots matted on top of the pan; moderately calcareous; pH 8.9; gradual boundary.

C2m—20 to 33 inches, pale-brown (10YR 6/3), thick platy hardpan, dark brown (10YR 4/3) when moist; cemented weakly to strongly but not so strongly as horizon above; moderately calcareous; pH 8.1; gradual boundary.

C3—33 to 60 inches, light brownish-gray (10YR 6/2), stratified fine and very fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive (structureless); slightly hard when dry, firm or friable when moist, slightly sticky and slightly plastic when wet; no roots; few to common fine pores; moderately calcareous; pH 8.8.

### DAY SERIES

Profile of Day clay in a range area located in the SE¼SE¼SE¼ sec. 6, T. 14 S., R. 16 E. (about 300 feet north of house and 150 feet west of section line):

A1—0 to 3 inches, reddish-brown (2.5YR 4/3) clay, dark reddish brown (10YR 3/4) when moist; strong, fine, granular structure; very hard when dry, friable when moist, very sticky and very plastic when wet; many to few roots; few pores; neutral (pH 6.8); abrupt boundary.

AC—3 to 19 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate to strong, coarse, prismatic structure breaking to strong, medium, blocky structure; glazing on vertical sides of peds; very hard when dry, firm when moist, very sticky and very plastic when wet; few large roots concentrated between vertical surfaces of peds; few pores; neutral (pH 6.9); clear boundary.

C1—19 to 31 inches, dark reddish-brown (2.5YR 3/3 dry, 2.5YR 3/4 moist) clay; moderate to strong, medium, blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; few roots; few fine pores; few chips of segregated lime; mildly alkaline (pH 7.4); clear boundary.

C2ca—31 to 55 inches, weak-red (10R 4/3 dry, 10R 4/4 moist) clay; weak, very thick, platy structure; very hard when dry, very firm when moist, very sticky and very plastic when wet; very few roots; few fine pores; few seams of soft, segregated and discontinuous lime; neutral (pH 7.3); clear boundary.

C3—55 to 96 inches, weak-red (10R 4/3) clay, dusky red (10R 3/3) when moist; laminated; very hard when dry, the hardness increasing with depth; no roots; few or no pores; slightly calcareous; common, distinct manganese-dioxide stains; mildly alkaline; many feet thick.

### DESCHUTES SERIES

Profile of Deschutes sandy loam in a range area located in the NE¼NW¼SW¼ sec. 6, T. 16 S., R. 14 E.:

A1—0 to 4 inches, light brownish-gray (10R 6/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium to coarse, platy structure breaking to very weak, fine, granular structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; pores mainly interstitial; mostly pumiceous material; neutral; clear, smooth boundary.

A3—4 to 11 inches, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; pores mainly interstitial but a few, medium, tubular pores; mostly pumiceous material; neutral; clear, smooth boundary.

B2—11 to 15 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; weak, subangular blocky structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; some roots; pores mainly interstitial; mostly pumiceous material; neutral; abrupt, irregular boundary.

IIC1—15 to 23 inches, pale-brown (10YR 6/3) light loam or fine sandy loam, dark brown (10YR 4/3) when moist; massive (structureless); hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; many fine and few medium tubular pores; small amounts of pumice, few basaltic pebbles and cobbles; neutral or mildly alkaline; abrupt, wavy boundary.

IIIR—23 inches +, basalt bedrock, silica coated in some places and lime coated in others.

### ELMORE SERIES

Profile of Elmore very stony loam (profile No. S55-Oreg.-7-5), located in the SE¼NW¼SE¼ sec. 9, T. 16 S., R. 15 E.:

A1—0 to 5 inches, grayish-brown (10YR 5/2) very stony loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft or slightly hard when dry, friable when moist, sticky and slightly plastic when wet; root mat or sodbound in uppermost part of horizon; common interstitial pores; some pumice; slightly acid (pH 6.3); gradual, irregular boundary.

A3—5 to 9 inches, grayish-brown (10YR 5/2) very stony loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy and weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; numerous roots; many medium pores; subangular pebbles, cobbles, channery fragments, their number increasing with depth; slightly acid (pH 6.3); clear, irregular boundary.

B1t—9 to 14 inches, dark-brown (10YR 4/3) very stony heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure breaking to weak, medium and fine, subangular blocky structure; slightly hard when dry, firm when moist, sticky and plastic when wet; common roots; common, fine, tubular pores; thin, patchy clay films; slightly acid (pH 6.4); clear, smooth boundary.

B21t—14 to 23 inches, dark-brown (10YR 4/3) very stony light clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure breaking to moderate, fine and medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; common roots; common, fine, tubular pores; thin, continuous clay films on vertical peds and in pores; some lime on lower surface of rhyolite fragments; neutral (pH 7.0); gradual, smooth boundary.

B22t—23 to 35 inches, dark-brown (10YR 4/3) very channery light clay loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few large roots; few, fine, tubular pores; common, patchy, thin clay films on ped surfaces and in pores; slightly acid (pH 6.5); lime occurs on lower surface of cobbles; gradual, smooth boundary.

B23t—35 to 50 inches, dark-brown (10YR 4/3) very channery clay loam; weak, medium and fine, angular and subangular blocky structure; slightly hard when dry, firm when moist, sticky and plastic when wet; few roots; few, fine, tubular pores; few, thin, patchy clay films on ped faces and in pores; mildly alkaline (pH 7.4); slightly calcareous, mainly in seams and fine nodules; abrupt boundary.

R—50 inches +, rhyolite bedrock.

### FORESTER SERIES

Profile of Forester loamy sand in a cultivated field located in the NW¼SE¼SW¼ sec. 6, T. 15 S., R. 16 E.:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure crushing to single grain (structureless); soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; pores mainly interstitial; pH 9.0 to 9.5; moderately calcareous, clear, smooth boundary.

AC—7 to 12 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure crushing to single grain (structureless); soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful roots; pores mainly interstitial; pH 9.0 to 9.6; strongly calcareous; gradual boundary.

C1—12 to 22 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonplastic and nonsticky

when wet; plentiful roots; pores mainly interstitial; few, slightly hard concretions ½ to ¾ inch in diameter; pH 8.6 to 9.6; strongly calcareous; clear boundary.

C2—22 to 27 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) when moist; massive; soft when dry, very friable when moist, nonplastic and nonsticky when wet; few roots; pores mainly interstitial; pH 8.6 to 9.6; strongly calcareous; clear to abrupt boundary.

IIC3—27 to 48 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; massive to weak platy structure; slightly hard or hard when dry, friable but slightly brittle when moist, slightly sticky and slightly plastic when wet; few, fine, tubular pores; pH 8.5 to 9.0; moderately calcareous; clear, wavy boundary.

IIC4—48 inches +, pale-brown (10YR 6/3), stratified silt loam, fine sandy loam, and loam, dark brown (10YR 4/3) when moist; massive; slightly hard or hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; few root channels; pH 8.5 to 9.0; moderately calcareous.

#### GEM SERIES

Profile of Gem very stony loam in a range area located in the SE¼SE¼SE¼ sec. 31, T. 14 S., R. 18 E. (400 feet north and 600 feet west of section corner):

A1—0 to 5 inches, grayish-brown (10YR 5/2) very stony loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular and weak, thin, platy structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; numerous roots; porous; slightly acid or neutral (pH 6.5 to 6.8); clear, wavy boundary.

A3—5 to 9 inches, grayish-brown (10YR 5/2) very stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium to fine, blocky structure crushing to fine, granular structure; hard when dry, friable or firm when moist, slightly sticky and slightly plastic when wet; common roots; porous; neutral (pH 6.8); clear, wavy boundary.

B1t—9 to 13 inches, brown (10YR 5/3) very stony light clay loam or heavy loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic and moderate, medium, blocky structure breaking to weak, fine, blocky structure; hard when dry, firm or friable when moist, slightly sticky and slightly plastic when wet; thin, patchy clay films on peds and in pores; common roots and root channels; neutral (pH 6.9 to 7.0); abrupt, wavy boundary.

B21t—13 to 20 inches, dark-brown (10YR 4/3) stony clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure breaking to moderate and strong, medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; roots concentrated along vertical surface of peds; moderately thick, very dark grayish-brown, continuous clay films on ped surfaces; neutral (pH 7.0 to 7.2); clear, smooth boundary.

B22t—20 to 26 inches, dark-brown (10YR 4/3) stony heavy clay loam, dark yellowish brown (10YR 3/4) when moist; moderate, medium, prismatic structure crushing to strong, fine and medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few pores; roots concentrated between peds; thick, very dark grayish-brown, continuous clay films on surface of peds; moderately alkaline (pH 8.0); calcareous; clear, wavy boundary.

B3tca—26 to 28 inches, light yellowish-brown (10YR 6/4) very stony clay loam, yellowish brown (10YR 5/4) when moist; moderate, medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; few pores; thin, continuous clay films on peds and in pores; moderately alkaline (pH 8.2); calcareous; abrupt to clear, wavy boundary.

R—28 inches +, lime-coated basalt fragments and basalt bedrock.

#### LAMONTA SERIES

Profile of Lamonta gravelly loam (profile No. S55-Oreg.-7-13), located in the NW¼NE¼SW¼ sec. 32, T. 13 S., R. 15 E.:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure breaking to weak, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; pores mainly interstitial; small amount of pale-brown pumice and numerous small, reddish, angular and subangular pebbles; neutral (pH 6.8); clear boundary.

B1—7 to 9 inches, brown (10YR 5/3) gravelly clay loam, dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; many, fine, tubular pores; thin, patchy clay films; rhyolite pebbles larger than in horizon above; slightly acid (pH 6.5); abrupt, wavy boundary.

B21t—9 to 20 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; moderate to strong, medium, prismatic structure breaking to moderate, fine and medium, blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; thick, continuous clay films on vertical and horizontal surfaces of peds; few to no pores; roots oriented between ped surfaces; mixed gravel increases in size with depth; neutral (pH 7.1); clear, wavy boundary.

B22t—20 to 23 inches, brown or yellowish-brown (10YR 5/3 to 5/4) gravelly clay, dark yellowish brown (10YR 4/4) when moist; moderate, medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; nearly continuous, thick clay films; mildly alkaline (pH 7.6); mildly calcareous; abrupt, smooth boundary.

Csim—23 to 36 inches +, pale-brown to light-gray (10YR 6/3 to 7/2), indurated, silica-cemented hardpan of gravelly loam or sandy loam; massive (structureless) to thick, platy structure; moderately alkaline (pH 8.2); thin, dense lenses of silica; lime in seams; common stains of manganese dioxide.

#### LOOKOUT SERIES

Profile of Lookout very stony loam in native range located in the NW¼NW¼SE¼ sec. 12, T. 15 S., R. 16 E.:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) very stony loam, dark grayish brown (10YR 4/2) when moist; moderate, thin and medium, platy structure crushing to fine, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; numerous roots and pores; top inch has many fine, vesicular pores; neutral (pH 6.7 to 6.8); clear, smooth to wavy boundary.

B1t—8 to 10 inches, grayish-brown (10YR 5/2) very stony light clay or heavy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate to strong, medium, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; numerous roots; less porous than horizon above; moderately thick, continuous clay films; neutral (pH 6.8); abrupt, wavy boundary.

B2t—10 to 18 inches, brown (10YR 5/3) very stony clay, dark brown to dark yellowish brown (10YR 3/3 to 3/4) when moist; strong, medium, prismatic structure breaking to strong, fine and medium, blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; few pores; roots concentrated along vertical surface of peds; distinct, thick, continuous, somewhat darker clay films and organic stains; neutral or mildly alkaline (pH 7.3 to 7.4); clear, irregular boundary.

B3tca—18 to 20 inches, yellowish-brown or light yellowish-brown (10YR 5/4 or 6/4) stony clay, dark brown (10YR 4/3) when moist; moderate, medium, blocky structure to strong, fine, blocky structure; hard

when dry, firm when moist, sticky and plastic when wet; few pores; few roots; thick, continuous clay films; moderately alkaline (pH 7.8 to 8.0); calcareous; segregated lime; abrupt, irregular boundary.

Csim—20 to 30 inches, light yellowish-brown (10YR 6/4), strongly cemented hardpan, dark brown (10YR 4/3) when moist; moderately thick, platy structure; several dark-brown, ⅛-inch silica lenses; moderately alkaline (pH 8.3); strongly calcareous; abrupt boundary.

R—30 inches +, basaltic bedrock.

### METOLIUS SERIES

Profile of Metolius sandy loam in a cultivated field located in the east half of SE¼NE¼NE¼ sec. 29, T. 16 S., R. 14 E.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; abundant roots; pores mainly interstitial; neutral; clear, smooth boundary.

C1—8 to 18 inches, light brownish-gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; massive (structureless); slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; few, fine, tubular pores, but pores mainly interstitial; neutral; gradual, smooth boundary.

C2—18 to 42 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; common, fine, tubular and interstitial pores; mildly alkaline; gradual, smooth boundary.

C3—42 to 60 inches +, light brownish-gray (10YR 6/2) sandy loam, dark brown (10YR 3/3) when moist; massive; soft when dry, friable when moist, nonsticky and nonplastic when wet; plentiful roots; common, fine, tubular and interstitial pores; mildly alkaline.

### OCHOCO SERIES

Profile of Ochoco sandy loam (profile No. S55–Oreg.–7–15), located in the southwest quarter of SW¼NW¼SE¼ sec. 13, T. 14 S., R. 15 E.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft or slightly hard when dry; very friable when moist, slightly sticky when wet; abundant roots; many pores; some pumice sand; neutral (pH 7.3); clear, smooth boundary.

A3—8 to 16 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; porous; neutral (pH 7.3); diffuse to clear boundary.

B1—16 to 21 inches, pale-brown (10YR 6/3) heavy fine sandy loam, dark brown (10YR 4/3) when moist; weak to moderate, medium, subangular blocky structure; slightly hard when dry, friable or firm when moist, slightly sticky and slightly plastic when wet; common roots; common, fine, tubular pores; thin, patchy clay films; neutral (pH 7.3); clear boundary.

B2t—21 to 28 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) when moist; weak to moderate, medium, prismatic structure breaking to moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, sticky and slightly plastic when wet; common roots; common, fine, tubular pores; thin, nearly continuous clay films on peds and in pores; few, rounded basaltic pebbles; neutral (pH 7.3); clear boundary.

B3—28 to 36 inches, brown to yellowish-brown (10YR 5/3 to 5/4) gravelly sandy clay loam, dark brown to dark yellowish brown (10YR 4/3 to 4/4) when moist; weak, medium, prismatic structure breaking to moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, sticky and slightly plastic when wet; roots few; common, fine, tubular pores; thin, patchy clay films; seams of lime in many places; mildly alkaline (pH 7.4); clear to abrupt boundary.

C1mca—36 to 46 inches, pale-brown (10YR 6/3), weakly to strongly cemented pan, brown to dark brown (10YR 5/3 to 3/3) when moist; moderate, coarse, platy structure to massive; pan occurs in hard and soft lenses; roots penetrate pan with difficulty; root mat on top of pan; lime occurs as hard, segregated lenses or seams; moderately alkaline (pH 8.0); clear boundary.

C2ca—46 to 60 inches, light-gray to very dark grayish-brown (10YR 6/1 to 3/2) sand, sandy loam, or very gravelly loamy sand, very dark grayish brown to grayish brown (10YR 3/2 to 5/2) when moist; weakly consolidated and weakly calcareous; moderately alkaline (pH 8.1); most pebbles are basalt, but some are andesite and rhyolite.

### ONTKO SERIES

Profile of Ontko clay loam in a cultivated meadow located in the NW¼ NW¼ NW¼ sec. 24, T. 14 S., R. 18 E.:

Ap—0 to 7 inches, black (10YR 2/1) clay loam, dark gray (10YR 4/1) when dry; weak to medium, thin, platy structure breaking to moderate, fine, granular structure; slightly hard when dry, firm when moist, sticky and plastic when wet; abundant roots; sod bound; pH 6.6; clear, smooth boundary.

A1—7 to 13 inches, clay loam, very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; firm when moist, sticky and plastic when wet; plentiful roots; numerous, distinct, fine mottles of dark reddish brown and large mottles of dark olive; pH 6.7 to 7.2; gradual boundary.

AC—13 to 22 inches, clay loam, very dark gray to dark grayish brown (10YR 3/1 to 4/2) when moist; weak, fine to medium, subangular blocky structure; friable or firm when moist, sticky and plastic when wet; few roots; pH 6.7 to 7.0; gradual boundary.

C1—22 to 43 inches, stratified loam, sandy clay loam, coarse sandy loam, and loamy coarse sand, very dark gray to dark grayish brown (10YR 3/1 to 4/2) when moist; massive; soft to hard when dry, friable when moist, sticky to nonsticky and slightly plastic to nonplastic when wet; few roots; pH 6.4 to 7.0; abrupt boundary.

C2—43 inches +, stratified sandy loam, silt loam, and silty clay loam, very dark grayish brown to dark brown (10YR 3/2 to 4/3) when moist; common, fine, faint mottles; massive; friable or firm when moist, slightly sticky and slightly plastic when wet; pH 6.2 to 7.6.

### POLLY SERIES

Profile of Polly gravelly loam in a range area located in the NW¼SE¼SE¼ sec. 22, T. 14 S., R. 17 E. (about 700 feet north of section corner and 20 feet west of Mill Creek Road):

A1—0 to 6 inches, dark-gray (10YR 4/1) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; pH 6.7 to 7.0; clear, wavy boundary.

B1t—6 to 10 inches, grayish-brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; weak to moderate, medium, prismatic structure and moderate to strong, fine, blocky structure; hard when dry, friable when moist, plastic and very sticky when wet; plentiful roots; moderately thick, nearly continuous clay films on peds and in large pores; pH 6.8 to 7.0; abrupt, wavy boundary.

B2t—10 to 18 inches, reddish-brown (5YR 5/4) heavy clay loam, reddish brown (5YR 4/4) when moist; weak to moderate, medium, prismatic structure and moderate to strong, fine and very fine, blocky structure; hard

when dry, firm when moist, very sticky and plastic when wet; few fine roots; very few pores; peds have thick, continuous clay films that are dark reddish brown when moist; slightly calcareous; small amount of segregated lime; pH 7.0 to 7.8; gradual, wavy boundary.

B3—18 to 27 inches, reddish-brown (5YR 5/4 dry, 5YR 4/4 moist) clay loam; weak, medium, prismatic structure and moderate, fine, blocky structure; hard when dry, firm or friable when moist, sticky and plastic when wet; few fine roots; very few pores; moderately thick, continuous clay films on peds; moderately calcareous; segregated lime; pH 7.6 to 8.2; gradual, wavy boundary.

C1ca—27 to 38 inches, yellowish-red (5YR 5/6) clay loam, reddish brown (5YR 4/4) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; very few pores; strongly calcareous; pH 8.0 to 8.4; clear, wavy boundary.

C2—38 to 72 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; no roots; very few pores; moderately to slightly calcareous; pH 7.8 to 8.2.

### POWDER SERIES

Profile of Powder loam, located in the NW¼NW¼SW¼ sec. 8, T. 15 S., R. 16 E. (400 feet south and 600 feet east of the west quarter corner):

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thin and medium, platy structure crushing to weak, medium, granular structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; numerous roots; porous; little pumice; neutral (pH 7.0); clear, smooth boundary.

AC—6 to 13 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; numerous roots and root channels; porous; little pumice; mildly alkaline (pH 7.5); clear, wavy boundary.

C1—13 to 25 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure crushing to medium, very fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common roots and root channels; moderately alkaline (pH 8.0); calcareous; clear, smooth boundary.

C2—25 to 31 inches, grayish-brown (10YR 5/2), stratified fine sandy loam and loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure to massive (structureless); soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common roots; porous; calcareous; moderately alkaline (pH 8.2); clear to abrupt boundary.

C3—31 to 41 inches, gray (10YR 5/1) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, blocky structure crushing to moderate, very fine, blocky structure; slightly hard when dry, friable or firm when moist, sticky and slightly plastic when wet; common roots; numerous worm casts and root channels; few pores; moderately alkaline (pH 8.3); calcareous; abrupt, wavy boundary.

C4—41 to 48 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, platy structure to massive (structureless) crushing to moderate, fine and very fine, blocky structure; slightly hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots and root channels; few pores; moderately alkaline (pH 8.2); calcareous; clear, smooth boundary.

C5—48 to 80 inches, light brownish-gray (10YR 6/2), stratified fine and very fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, friable when moist, slightly sticky and nonplastic when wet; few roots; porous; moderately alkaline (pH 8.2); calcareous.

### PRINEVILLE SERIES

Profile of Prineville sandy loam (profile No. S55-Oreg.-7-18), located in the SE¼NW¼NE¼ sec. 8, T. 14 S., R. 15 E.:

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, friable when moist, nonsticky and nonplastic when wet; roots common; porous; moderate pumice content; neutral (pH 7.1); gradual, irregular boundary.

A3—9 to 16 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thick, platy structure crushing to weak, fine, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; roots common; mildly alkaline (pH 7.8); gradual boundary.

B2—16 to 20 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; common, fine roots; moderately alkaline (pH 8.2); clear, wavy boundary.

C1m—20 to 32 inches, pale-brown (10YR 6/3) very fine sandy loam, pale brown (10YR 5/3) when moist; weak, thick, platy structure breaking to moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few roots; lenses are weakly cemented; few, hard, 1-inch nodules that are strongly calcareous; slightly calcareous matrix; strongly alkaline (pH 8.6); clear, wavy boundary.

C2m—32 to 47 inches, pale-brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, thin to thick, platy structure; very hard when dry, very firm when moist; few root channels; lenses weakly cemented; thin lenses of hard, segregated lime; calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.

C3—47 to 60 inches, light brownish-gray (10YR 6/2) gravelly loamy fine sand, dark grayish brown (10YR 4/2) when moist; massive (structureless); soft when dry, friable when moist; few, firm lenses of lime; strongly alkaline (pH 8.5); slightly calcareous; diffuse, gradual boundary to partially consolidated, pumiceous or tuffaceous sandstone or agglomerate.

### REDMOND SERIES

Profile of Redmond sandy loam in range area located in the NW¼NW¼SE¼ sec. 10, T. 15 S., R. 14 E.:

A1—0 to 5 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; pores mainly interstitial; neutral; clear, smooth boundary.

A3—5 to 11 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure breaking to weak, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; many, fine, tubular pores; neutral; clear, smooth boundary.

B1t—11 to 19 inches, brown (10YR 5/3) heavy sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; soft when dry; friable when moist, slightly sticky and slightly plastic when wet; plentiful roots; common, fine, tubular pores; neutral or mildly alkaline; clear, smooth boundary.

B2t—19 to 25 inches, brown (10YR 5/3) loam or sandy clay loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; plentiful roots; many, fine, tubular pores; neutral or mildly alkaline; clear, smooth boundary.

C1—25 to 30 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; weak, medium, platy structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many, fine and few, medium, tubular pores; mildly alkaline; clear, smooth boundary.

C2ca—30 to 33 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive (structureless) to weak, thick, platy structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; plentiful roots; many, fine, tubular pores; calcareous; mycelial lime; moderately alkaline; abrupt, wavy boundary.

IIR—33 inches +, basalt bedrock.

### SALISBURY SERIES

Profile of Salisbury very stony loam in range area located in the southeast quarter of NW¼NE¼SE¼ sec. 14, T. 15 S., R. 16 E. (about 700 feet west and 400 feet south of the east quarter corner):

A1—0 to 4 inches, grayish-brown (10YR 5/2) very stony loam, very dark brown (10YR 2/2) when moist; moderate, thin and very thin, platy structure breaking to moderate, fine, granular structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; many interstitial pores; pH 6.5 to 6.9; clear, smooth boundary.

A3—4 to 8 inches, grayish-brown (10YR 5/2) very stony gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; abundant roots; common, fine, tubular pores; pH 6.7 to 7.0; clear, wavy boundary.

B1t—8 to 13 inches, brown (7.5YR 5/2) very stony heavy clay loam or gravelly light clay, dark brown (7.5YR 3/2) when moist; weak to moderate, medium, prismatic structure breaking to moderate or strong, fine and very fine, blocky structure; hard when dry, firm when moist, sticky and plastic when wet; plentiful roots; common, fine, tubular pores; moderately thick, continuous clay films on ped surfaces and in large pores; pH 6.7 to 7.2; clear, smooth boundary.

B2t—13 to 21 inches, dark-brown (7.5YR 4/3) very stony clay, dark brown (7.5YR 3/3) when moist; strong, medium, prismatic structure breaking to strong, fine and very fine, blocky structure; hard or very hard when dry, very firm when moist, very sticky and very plastic when wet; some roots; very few pores; thick, continuous clay films on ped surfaces and in pores; pH 6.7 to 7.5; abrupt, smooth boundary.

C1m—21 to 27 inches, light yellowish-brown (10YR 6/4), strongly cemented to indurated, gravelly hardpan, dark yellowish brown (10YR 4/4) when moist; no roots; calcareous; pH 7.0 to 8.2; gradual boundary.

C2m—27 to 38 inches, pale-brown (10YR 6/3), strongly cemented, gravelly hardpan, dark brown (10YR 4/3) when moist; no roots; calcareous; pH 8.0 to 8.4; abrupt boundary.

R—38 inches +, basalt bedrock.

### SEARLES SERIES

Profile of Searles stony loam (profile No. S55–Oreg.–7–7) on a south-facing slope of 30 percent, located in SE¼SW¼NE¼ sec. 9, T. 16 S., R. 15 E.:

A1—0 to 3 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure breaking to weak, fine, granular structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; neutral (pH 6.8); clear, smooth boundary.

A3—3 to 8 inches, grayish-brown (10YR 5/2) stony loam, very dark brown to very dark grayish brown (10YR 2/2 to 3/2) when moist; weak, medium, platy structure breaking to weak, fine, subangular blocky structure; slightly hard when dry, friable when moist; slightly sticky and slightly plastic when wet; neutral (pH 6.8); clear, irregular boundary.

B21t—8 to 18 inches, brown to dark-brown (10YR 5/3 to 4/3) very gravelly or stony heavy loam or light clay loam, dark brown (10YR 3/3) when moist; weak to moderate, medium, prismatic structure breaking to moderate, medium and fine, angular and subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; neutral (pH 7.0); gradual, smooth boundary.

B22t—18 to 25 inches, brown (10YR 5/3) very stony or very gravelly heavy loam or light clay loam, dark brown (10YR 3/3) when moist; weak, medium and fine, blocky structure with very weak, vertical parting; hard when dry, firm when moist, sticky and plastic when wet; neutral (pH 7.3); lime on lower face of coarse fragments; gradual, smooth boundary.

C—25 to 40 inches, brown (10YR 5/3) very stony or very gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard when dry, friable or firm when moist, slightly sticky and plastic when wet; neutral (pH 7.2); 80 percent or more stones; lime on lower face of coarse fragments; clear to abrupt boundary.

R—40 inches +, banded gray, white, pink, and reddish rhyolite that, in places, is capped by 1 to 4 inches of strongly cemented to indurated lime and silica hardpan lenses.

### SLAYTON SERIES

Profile of Slayton sandy loam in a range area located in the NW¼SW¼SE¼ sec. 22, T. 14 S., R. 16 E. (nearly opposite a large outcrop of rock in an adjacent cultivated field):

A1—0 to 4 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure crushing to weak, fine, granular structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; abundant roots; porous; numerous, small, pale-green chips and angular pebbles as well as some channery fragments of tuff on and in surface; moderate amounts of pale-brown, fine and medium-sized pumice sand; neutral (pH 6.6); irregular, clear boundary.

AC—4 to 8 inches, light brownish-gray (10YR 6/2) fine gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; common roots; porous; small to moderate amount of pumice; few to many fine chips; neutral (pH 6.8); clear, wavy boundary.

C—8 to 14 inches, light brownish-gray (10YR 6/2) channery sandy loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; few roots; porous; mostly noncalcareous, but in places there are lime coatings on lower side of channery fragments; neutral (pH 7.0–7.2); abrupt boundary.

R—14 inches +, pale-green to light yellowish-green sandy tuff that fractures readily in the upper 2 or 3 inches into horizontal plates about 1 inch thick; fragments stained with manganese dioxide and lime in places.

### STEARNS SERIES

Profile of Stearns silt loam (profile No. S55–Oreg.–7–10), located in the SE¼SE¼SW¼ sec. 19, T. 15 S., R. 16 E. (about 60 feet west of State Route 27 and 300 feet north of the section line):

A21—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, thin to very thin, platy structure; soft or slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; neutral (pH 6.8); clear boundary.

A22—3 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and thin, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; neutral (pH 7.3); abrupt boundary.

B2t—5 to 13 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate to strong, medium, prismatic structure breaking to strong, fine, blocky structure; hard when dry, firm when moist, very sticky and very plastic when wet; moderately thick, continuous clay films on peds; organic stains on faces of prisms; calcareous; very strongly alkaline (pH 9.2); abrupt boundary.

C1m—13 to 22 inches, light brownish-gray (10YR 6/2) silt loam; massive (structureless) to weak, thick, platy structure; very hard or hard when dry, very firm when wet, slightly sticky and slightly plastic when wet; roots are restricted, but a few roots penetrate pan; weakly lime cemented; slightly calcareous; very strongly alkaline (pH 9.6); gradual boundary.

C2m—22 to 36 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 3/3) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; very few fine roots; many fine pores; very weakly lime cemented; strongly calcareous; very strongly alkaline (pH 9.2); clear boundary.

C3—36 to 48 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; somewhat stratified; massive; slightly hard when dry, friable or firm when moist, slightly sticky and slightly plastic when wet; slightly calcareous; strongly alkaline (pH 8.9).

C4—48 to 60 inches, pale brown (10YR 6/3), stratified fine sandy loam, very fine sandy loam, and silt loam, dark brown (10YR 4/3) when moist; slightly calcareous; strongly alkaline (pH 8.7).

### STEIGER SERIES

Profile of Steiger sandy loam in a cultivated field located in the NE¼SE¼SW¼ sec. 4, T. 14 S., R. 19 E. (about 2,000 feet east and 1,300 feet north of the section corner):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure breaking to weak, fine, granular structure; soft or slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; abundant roots and root channels; porous; few basaltic pebbles; neutral (pH 6.6); abrupt boundary.

AC—7 to 14 inches, grayish-brown to pale-brown (10YR 5/2 to 6/3) sandy loam, higher in content of medium and fine pumice than horizon above, very dark grayish brown grading to dark brown (10YR 3/2 to 3/3) when moist; weak, medium and fine, subangular blocky structure crushing to weak, fine, granular structure; soft or slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; numerous roots; porous; neutral (pH 6.8); clear, wavy boundary.

C1—14 to 22 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 3/3 to 4/3) when moist; moderate pumice content; weak, medium and fine, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; roots common; numerous pores; neutral (pH 6.9 or 7.0); clear, irregular boundary.

C2—22 to 28 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; massive (structureless) to weak, coarse, subangular blocky structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots; porous; few, weakly calcareous, fine shot; mildly alkaline (pH 7.6); clear, irregular boundary.

C3—28 to 69 inches, pale-brown (10YR 6/3), stratified sandy loam and fine sandy loam, dark brown (10YR 3/3) when moist; massive, with pumice standing out as single grains; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; few roots; porous; mildly alkaline (pH 7.5); gradual transition to more gravelly strata below.

### SWARTZ SERIES

Profile of Swartz silt loam (profile No. S55–Oreg.–7–1), located in the SE¼SW¼SE¼ sec. 34, T. 14 S., R. 15 E. (about 1,800 feet west and 50 feet north of section corner):

A1—0 to 2 inches, gray (10YR 5/1) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common roots; porous; many vesicular pores; silt lining in pores; slightly acid (pH 6.2); clear, smooth boundary.

A2—2 to 5 inches, light-gray (10YR 7/1) silt loam, gray (2.5Y 5/1) when moist; moderate, thin, platy structure; slightly hard when dry, firm when moist, sticky and slightly plastic when wet; roots common; slightly porous, the pores filled with silt; neutral (pH 6.6); abrupt, irregular boundary.

B21t—5 to 13 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, columnar structure breaking to strong, fine, blocky structure; hard when dry, firm or very firm when moist, very sticky and very plastic when wet; few roots restricted to vertical surfaces of peds; few pores; coating of bleached silt on top of columns: thick, continuous clay films on vertical surfaces of peds; neutral (pH 6.6); clear, wavy boundary.

B22t—13 to 22 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, medium and coarse, prismatic structure breaking to strong, fine and medium, blocky structure; hard when dry, very firm when moist, sticky and plastic when wet; roots very few and confined to areas between vertical surfaces of peds; very few pores; thick, continuous clay films on peds and in pores; neutral (pH 6.9); gradual, smooth boundary.

B3t—22 to 32 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, medium, blocky structure; hard when dry, firm or very firm when moist, sticky and plastic when wet; roots very few or none; continuous, moderately thick clay films; higher proportion of pumice than horizon above; mildly alkaline (pH 7.4); gradual, smooth boundary.

C1—32 to 44 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, fine and medium, blocky structure; hard when dry, firm or very firm when moist, sticky and plastic when wet; no roots; no pores; mildly alkaline (pH 7.6); gradual, smooth boundary.

C2—44 to 60 inches, dark grayish-brown (2.5Y 4/2) light clay, very dark grayish brown (2.5Y 3/2) when moist; massive; hard when dry, firm or very firm when moist, plastic and sticky when wet; no roots; no pores; mildly alkaline (pH 7.7); gradual transition to either basalt bedrock or lacustrine sediments at a depth of few to many feet.

### VEAZIE SERIES

Profile of Veazie loam in a pasture located in the SE¼SE¼SW¼ sec. 13, T. 14 S., R. 18 E. (about 300 feet west and 200 feet north of the south quarter corner):

A1—0 to 9 inches, dark-gray (10YR 4/1) loam, very dark brown (10YR 2/2) when moist; weak or moderate, thin and very thin, platy structure crushing to weak, fine, granular structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; pores mainly interstitial; pH 6.6 to 7.0; clear, smooth boundary.

AC—9 to 16 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; abundant roots; pores mainly interstitial; pH 6.6 to 7.0; clear, smooth boundary.

C1—16 to 24 inches, grayish-brown (10YR 5/2), stratified loam, silt loam, and very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly

plastic when wet; plentiful roots; pH 6.6 to 7.0; abrupt, smooth boundary.

IIC2—24 inches +, grayish-brown (10YR 5/2) very gravelly sand, very dark grayish brown (10YR 3/2) when moist; single grain (structureless); loose when dry and when moist, nonsticky and nonplastic when wet; few roots; dominantly stratified gravel and sand, with thin layers of loam or very fine sandy loam in places; pH 6.6 to 7.0.

## Laboratory Data

Table 11 gives laboratory data for nine selected soils, each a soil of an important series. The series are Ayres, Crooked, Elmore, Lamonta, Ochoco, Prineville, Searles, Stearns, and Swartz. The profiles of these soils are described in the subsection "Descriptions of Soil Profiles."

Standard methods were used to obtain the data in table 11. Particle-size distribution was determined by use of the pipette method (*3*). To determine pH, laboratory distilled water was added to 20 grams of soil to make a consistency of the saturation percentage, and allowed to stand for 1 hour before reading the pH in a Beckman Model H-2 meter. The same sample was subsequently diluted with distilled water to a 1:10 soil-water ratio, and the pH was determined after 1 hour. The electrodes were placed deep in the suspension immediately after the final stirring.

Organic carbon was determined by the $K_2Cr_2O_7$-$H_2SO_4$ heat of dilution method described in "Methods of Soil Analysis for Soil-Fertility Investigations," U.S. Department of Agriculture Circular No. 757 (*5*). Soil was removed by filtration prior to titration with $FeSO_4$ and ortho-phenanthroline as indicator. Organic carbon was calculated on the basis of 77 percent oxidation of organic matter.

Total nitrogen was determined by the Kjeldahl method. Electrical conductivity of the saturation extract was analyzed by a method described in "Diagnosis and Improvement of Saline and Alkali Soils," U.S. Department of Agriculture Handbook No. 60 (*12*). The calcium carbonate equivalent was determined by measuring the volume of carbon dioxide evolved from soil samples treated with four normal hydrochloric acid (HCl) in a 50-milliliter test tube. Carbon dioxide was removed by vacuum at short intervals, and a trap containing cotton was used to prevent the loss of water vapor.

Measurement of moisture retention at 1/10, 1/3, and 15 atmospheres were made by methods 29, 30, and 31, respectively, described in USDA Handbook No. 60. Method 19 of USDA Handbook No. 60 was followed to determine cation exchange capacity, except that 10 grams of soil were used. Following the removal of $NH_4Ac$ and organic matter by dehydration with $HNO_3$ and HCl, and after silica was dehydrated with six normal HCl, the residue was dissolved in 0.4 normal HCl, and sodium was determined by a Beckman Model DU flame spectrophotometer.

Methods described in USDA Circular No. 575 (*5*) were used to extract and to prepare alkali- and alkaline-earth cations for analyses. Fifty grams of soil were extracted with one normal neutral $NH_4Ac$. Calcium was precipitated as the oxalate and titrated with permanganate; Mg as ammonium magnesium phosphate, ignited and weighed as $MgP_2O_7$. Separate aliquots of the $NH_4Ac$ extracts for sodium and potassium were treated the same as $NH_4Ac$ for determinations of cation exchange capacity. Sodium and potassium were analyzed in 0.4 normal HCl by a Beckman flame spectrophotometer. Determinations of extractable hydrogen were made by the triethanolamine method described in USDA Circular No. 757.

Sodium and potassium in the saturation extract were analyzed by use of a Beckman flame spectrophotometer. Calcium and magnesium were determined according to Method 7 in USDA Handbook No. 60. Extractable Na and K were obtained by subtracting soluble Na and K in the saturation extract from the $NH_4Ac$-extractable values. The values for extractable Ca and Mg consist of the exchangeable values added to the Ca and Mg in soluble salts, gypsum, and carbonates, if present.

In noncalcareous samples the cation exchange capacity is the sum of Ca, Mg, H, Na, and K. The base saturation percentage is obtained if the extractable hydrogen is subtracted from this sum, and if the result is divided by the sum of the cations, including H, and multiplied by 100.

In calcareous samples the extractable Na divided by the cation exchange capacity, as determined by NaAc procedure, multiplied by 100 represents the exchangeable Na present.

In soils derived from pumice and volcanic glass, and possibly in soils from some weathered basalts, the density and shape of particles differ considerably from those in soils derived from such minerals as quartz, fledspars, "heavy" minerals, and clay minerals of the 2:1 lattice type. When determining particle-size distribution by the pipette method, consideration should be given to the effect of density and shape of particles on settling velocity.

In addition, particles shape influences the moisture retained at various levels of pressure, as do fine pores that may be present. The moisture held at a tension of 15 atmospheres is influenced by the amount and nature of the surface-force field of the soil particles and not by the size of the "capillary" pores. However, the surface-force field of a 2:1 lattice-type clay mineral differs from that of a pumice particle having pores of various sizes. In coarse-textured soils a high percentage of moisture held at a tension of 15 atmospheres may result from a high content of particles with fine pores.

In table 11 the percentage of particles larger than 2 millimeters includes fragments as large as 1 inch across. Coarse fragments larger than about 1 inch across were excluded from samples brought to the laboratory, but estimates of coarse fragments are given in the profile descriptions.

# *Facts About Crook County*

This section provides general information about the climate, history, population, transportation and markets, water supply, land use, and agriculture of Crook County.

## Climate [3]

Crook County is just outside the northwest corner of the Great Basin. The climate is semiarid, the nights are fairly cool throughout the year, and most of the annual precipitation occurs in winter.

[3] GILBERT L. STERNES, State climatologist, prepared this subsection.

TABLE 11.—*Laboratory data on some*

[Analyses by Soil Survey Laboratory, SCS, Riverside,

| Soil type and profile number | Depth | Horizon | Particle-size distribution | | | | | | | | | | pH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand (2.0–1.0 mm.) | Coarse sand (1.0–0.5 mm.) | Medium sand (0.5–0.25 mm.) | Fine sand (0.25–0.10 mm.) | Very fine sand (0.10–0.05 mm.) | Silt (0.05–0.002 mm.) | Clay (less than 0.002 mm.) | Other size classes: 0.2 to 0.02 mm. | Other size classes: 0.02 to 0.002 mm. | Other size classes: Larger than 2 mm. | Saturated paste | 1:10 suspension |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | | |
| Ayres gravelly sandy loam: S55-Oreg.-7-3. | 0–5 | A1 | 1.9 | 10.7 | 17.4 | 24.9 | 10.0 | 23.0 | 12.1 | 31.6 | 13.2 | 17 | 6.8 | 6.9 |
| | 5–8 | A3 | 1.5 | 10.4 | 15.5 | 23.3 | 9.8 | 24.2 | 15.3 | 30.4 | 15.2 | 11 | 6.8 | 7.1 |
| | 8–14 | B2t | 1.4 | 7.1 | 9.6 | 16.7 | 9.3, | 26.6 | 29.3 | 28.1 | 16.8 | 10 | 7.1 | 7.2 |
| | 14–29 | C1sim | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | ------ | ------ |
| | 29–50+ | C2 | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| Crooked sandy loam: S55-Oreg.-7-11.[2] | 0–6 | Ap | 1.3 | 12.3 | 16.3 | 26.6 | 12.4 | 24.7 | 6.4 | 38.2 | 12.8 | 0 | 9.1 | 9.8 |
| | 6–13 | AC | 1.5 | 12.1 | 14.8 | 27.3 | 15.5 | 22.1 | 6.7 | 44.9 | 8.1 | 1 | 9.4 | 9.9 |
| | 13–20 | C1m | 1.3 | 4.3 | 5.1 | 20.3 | 26.5 | 34.5 | 8.0 | 63.9 | 11.7 | 2 | 8.6 | 9.6 |
| | 20–33 | C2m | .3 | 3.6 | 6.3 | 33.3 | 28.0 | 23.7 | 4.8 | 68.4 | 8.0 | 0 | 8.1 | 8.9 |
| | 33–48 | C3 | .3 | 2.4 | 4.4 | 25.8 | 31.1 | 32.2 | 3.8 | 71.4 | 11.5 | 0 | 8.8 | 9.1 |
| Elmore very stony loam: S55-Oreg.-7-5. | 0–5 | A1 | 1.2 | 3.5 | 3.3 | 13.0 | 14.1 | 48.3 | 16.6 | 45.0 | 26.4 | 14 | 6.3 | 6.6 |
| | 5–9 | A3 | 1.8 | 3.2 | 3.3 | 11.4 | 13.9 | 45.5 | 20.9 | 42.3 | 25.0 | 11 | 6.3 | 6.5 |
| | 9–14 | B1t | 1.6 | 2.5 | 2.6 | 11.3 | 14.2 | 43.3 | 24.5 | 42.1 | 23.2 | 19 | 6.4 | 6.6 |
| | 14–23 | B21t | 1.2 | 2.0 | 2.4 | 11.2 | 17.6 | 37.6 | 28.0 | 41.8 | 21.8 | 41 | 7.0 | 7.0 |
| | 23–35 | B22t | 1.5 | 1.6 | 1.8 | 10.1 | 15.1 | 41.0 | 28.9 | 42.5 | 21.1 | 39 | 6.5 | 6.5 |
| | 35–50 | B23t | 1.4 | 3.3 | 3.8 | 12.3 | 15.0 | 32.1 | 32.1 | 36.4 | 19.3 | 44 | 7.0 | 7.4 |
| | 50+ | (4) | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| Lamonta gravelly loam: S55-Oreg.-7-13. | 0–7 | Ap | 3.3 | 5.3 | 6.9 | 18.3 | 13.4 | 36.9 | 15.9 | 42.4 | 18.7 | 14 | 6.7 | 6.9 |
| | 7–8½ | B1 | 3.2 | 4.8 | 5.8 | 15.5 | 10.4 | 31.3 | 29.0 | 12.8 | 38.2 | 26 | 6.5 | 6.7 |
| | 8½–20 | B21t | 1.3 | 2.6 | 2.7 | 7.1 | 5.0 | 17.6 | 63.7 | 18.4 | 8.4 | 13 | 7.1 | 8.1 |
| | 20–23 | B22t | 2.3 | 3.4 | 3.1 | 6.7 | 4.9 | 16.5 | 63.1 | 16.1 | 9.4 | 18 | 7.6 | 8.4 |
| | 23–36 | Csim | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | (1) | ------ | ------ |
| Ochoco sandy loam: S55-Oreg.-7-15. | 0–8 | Ap | 1.2 | 10.9 | 21.7 | 30.4 | 8.0 | 18.7 | 9.1 | 31.3 | 9.1 | 4 | 7.3 | 7.5 |
| | 8–16 | A3 | 1.2 | 10.6 | 21.7 | 29.3 | 8.0 | 18.7 | 10.5 | 29.8 | 9.8 | 7 | 7.3 | 7.5 |
| | 16–21 | B1 | 1.3 | 8.6 | 16.2 | 23.1 | 8.5 | 24.2 | 18.1 | 31.7 | 12.0 | 3 | 7.3 | 7.6 |
| | 21–28 | B2t | 1.1 | 7.1 | 14.6 | 22.2 | 9.2 | 24.4 | 21.4 | 32.4 | 12.2 | 4 | 7.3 | 7.6 |
| | 28–36 | B3 | 2.1 | 13.3 | 23.3 | 25.8 | 4.8 | 8.9 | 21.8 | 19.6 | 4.8 | 20 | 7.4 | 7.8 |
| | 36–46 | C1mca | (5) | (5) | (5) | (5) | (5) | (5) | (5) | (5) | (5) | (5) | ------ | ------ |
| | 46–60 | C2ca | 1.5 | 17.7 | 38.6 | 38.5 | 0 | .6 | 3.1 | 12.5 | 1.5 | 7 | 8.1 | 9.0 |
| Prineville sandy loam: S55-Oreg.-7-18. | 0–9 | Ap | 2.1 | 12.9 | 17.2 | 25.6 | 12.4 | 22.9 | 6.9 | 37.4 | 11.1 | 3 | 7.1 | 7.1 |
| | 9–16 | A3 | 1.6 | 10.2 | 14.5 | 26.3 | 16.0 | 23.1 | 8.3 | 45.0 | 9.0 | 4 | 7.7 | 7.8 |
| | 16–20 | B2 | 1.6 | 8.3 | 11.5 | 23.1 | 18.6 | 26.4 | 10.5 | 46.3 | 12.4 | 5 | 8.2 | 8.7 |
| | 20–32 | C1m | 1.5 | 5.9 | 6.9 | 18.9 | 24.5 | 29.1 | 3.2 | 61.8 | 14.8 | 4 | 8.6 | 9.2 |
| | 32–47 | C2m | 1.2 | 5.1 | 6.8 | 21.5 | 25.3 | 40.1 | 0 | 62.8 | 17.5 | 5 | 8.6 | 9.2 |
| | 47–60 | C3 | 1.9 | 8.3 | 12.7 | 30.3 | 23.1 | 23.7 | 0 | 57.5 | 8.5 | 22 | 8.5 | 9.0 |
| Searles stony loam: S55-Oreg.-7-7. | 0–3 | A1 | 3.6 | 6.0 | 4.9 | 13.6 | 15.3 | 38.7 | 17.9 | 41.4 | 22.0 | 47 | 6.8 | 6.9 |
| | 3–8 | A3 | 3.1 | 5.3 | 4.5 | 12.1 | 14.4 | 38.4 | 22.2 | 38.1 | 23.1 | 49 | 6.8 | 7.0 |
| | 8–18 | B21t | 2.7 | 4.1 | 3.6 | 11.1 | 14.2 | 37.8 | 26.5 | 37.1 | 22.7 | 53 | 7.0 | 7.1 |
| | 18–25 | B22t | 3.7 | 3.9 | 3.4 | 11.1 | 14.2 | 37.7 | 25.8 | 36.9 | 23.1 | 54 | 7.3 | 7.2 |
| | 25–40 | C | 3.1 | 3.3 | 4.4 | 17.5 | 21.3 | 32.8 | 17.6 | 47.9 | 19.0 | 60 | 7.2 | 7.4 |
| | 40+ | (4) | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

See footnotes at end of table.

*selected soils of the Prineville Area*

California. Dashes indicate data not available or not determined]

| Organic matter | | | Electrical conductivity ($EC \times 10^3$) mmhos. per cm. at 25° C. | $CaCO_3$ equivalent | Moisture held at tensions of— | | | Moisture at saturation | Cation exchange capacity (Na) | Extractable cations (meq. per 100 gm.) | | | | | Base saturation | Saturation extract soluble (meq. per liter) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Organic carbon | Nitrogen | C/N ratio | | | 1/10 atmosphere | 1/3 atmosphere | 15 atmospheres | | | Ca | Mg | H | Na | K | | Na | K | Ca + Mg |
| *Percent* | *Percent* | | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Meq. per 100 gm.* | | | | | | *Percent* | | | |
| 0.73 | 0.064 | 11.4 | 0.5 | ------ | 28.0 | 21.3 | 9.8 | ------ | 19.8 | 9.6 | 4.7 | 2.6 | 0.4 | 1.5 | 86 | ------ | ------ | ------ |
| .55 | .061 | 9.0 | .4 | ------ | 30.5 | 24.2 | 11.6 | ------ | 24.2 | 11.5 | 5.6 | 3.3 | .2 | 1.2 | 85 | ------ | ------ | ------ |
| .65 | .072 | 9.0 | .4 | ------ | 38.3 | 29.3 | 17.2 | ------ | 40.3 | 21.8 | 11.5 | 2.8 | .8 | 1.4 | 93 | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| .57 | .056 | 10.2 | 2.3 | 2 | 34.2 | 20.1 | 16.5 | 39.8 | 21.7 | 17.6 | 2.3 | ------ | 9.5 | 5.2 | [3] 44 | 25.0 | 1.0 | 2.0 |
| .33 | .037 | 8.9 | 1.9 | 4 | 31.9 | 20.3 | 18.0 | 42.8 | 21.6 | 16.2 | 3.5 | ------ | 11.2 | 4.6 | [3] 52 | 21.8 | .7 | 6.2 |
| .22 | .023 | 9.6 | 1.9 | 6 | 45.4 | 30.3 | 23.1 | 51.3 | 40.4 | 17.9 | 11.5 | ------ | 17.9 | 6.9 | [3] 44 | 20.0 | .6 | 2.2 |
| .14 | .016 | 8.8 | 1.7 | 3 | 35.7 | 20.3 | 13.5 | 40.9 | 27.6 | 24.9 | 8.9 | ------ | 3.5 | 1.8 | [3] 13 | 13.4 | .3 | 4.4 |
| .13 | ------ | ------ | 1.5 | 5 | 39.4 | 24.9 | 14.0 | 43.3 | 35.0 | 24.1 | 10.9 | ------ | 11.0 | 5.3 | [3] 31 | 15.2 | .5 | 1.2 |
| 2.40 | .182 | 13.2 | .5 | ------ | 50.5 | 31.3 | 12.6 | ------ | 26.6 | 11.5 | 5.8 | 5.4 | .2 | 1.8 | 78 | ------ | ------ | ------ |
| 1.69 | .142 | 11.9 | .5 | ------ | 49.9 | 27.4 | 13.4 | ------ | 27.9 | 12.5 | 6.8 | 5.3 | .2 | 1.5 | 80 | ------ | ------ | ------ |
| 1.47 | .127 | 11.6 | .4 | ------ | 46.8 | 27.3 | 14.5 | ------ | 30.5 | 13.7 | 8.0 | 5.7 | .2 | 1.3 | 80 | ------ | ------ | ------ |
| 1.04 | .096 | 10.8 | .5 | ------ | 41.1 | 28.4 | 32.1 | ------ | 39.3 | 16.9 | 12.2 | 4.7 | .7 | 1.9 | 87 | ------ | ------ | ------ |
| 1.41 | .135 | 10.4 | .5 | ------ | 42.4 | 29.2 | 17.4 | ------ | 36.5 | 16.8 | 10.6 | 5.7 | .3 | 1.6 | 84 | ------ | ------ | ------ |
| .45 | .047 | 9.6 | .5 | ------ | 36.1 | 26.6 | 16.1 | ------ | 35.5 | 14.8 | 30.2 | 3.2 | .7 | 1.4 | 94 | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| 1.13 | .092 | 12.3 | .5 | ------ | 38.4 | 24.0 | 10.4 | ------ | 22.8 | 11.2 | 5.2 | 2.7 | .5 | 2.1 | 88 | ------ | ------ | ------ |
| .87 | .058 | 15.0 | .5 | ------ | 42.4 | 29.2 | 15.8 | ------ | 33.9 | 15.5 | 8.5 | 2.6 | 1.0 | 1.8 | 91 | ------ | ------ | ------ |
| .59 | .057 | 10.4 | .3 | ------ | 86.9 | 67.8 | 38.2 | ------ | 69.9 | 35.8 | 23.9 | 4.3 | 2.6 | 2.6 | 94 | ------ | ------ | ------ |
| .59 | ------ | ------ | .5 | ------ | 88.6 | 71.8 | 40.2 | ------ | 76.5 | 42.2 | 27.5 | 3.1 | 3.2 | 2.5 | 96 | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| .64 | .062 | 10.3 | .6 | ------ | 24.6 | 16.5 | 7.1 | ------ | 16.3 | 9.8 | 3.8 | 1.4 | .6 | 1.0 | 92 | ------ | ------ | ------ |
| .34 | .039 | 8.7 | .5 | ------ | 25.4 | 16.0 | 8.1 | ------ | 17.3 | 9.9 | 4.7 | .8 | .5 | 1.0 | 95 | ------ | ------ | ------ |
| .23 | .031 | 7.4 | .4 | ------ | 31.1 | 20.9 | 10.3 | ------ | 23.5 | 12.7 | 7.6 | .8 | .6 | 1.3 | 97 | ------ | ------ | ------ |
| .18 | .026 | 6.9 | .5 | ------ | 34.9 | 23.7 | 12.0 | ------ | 27.5 | 15.0 | 9.9 | .9 | .5 | 1.6 | 97 | ------ | ------ | ------ |
| .17 | .021 | 8.1 | .6 | ------ | 30.2 | 22.1 | 12.7 | ------ | 28.1 | 15.8 | 11.0 | .7 | .5 | 1.5 | 98 | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |
| .06 | ------ | ------ | .5 | 1 | 5.6 | 4.5 | 3.3 | ------ | 9.6 | 15.7 | 3.6 | ------ | .4 | .6 | 100 | ------ | ------ | ------ |
| .67 | .067 | 10.0 | .7 | ------ | 29.5 | 17.9 | 8.4 | ------ | 17.9 | 9.1 | 4.4 | 1.7 | .7 | 1.5 | 90 | ------ | ------ | ------ |
| .50 | .054 | 9.3 | .5 | ------ | 31.8 | 17.5 | 8.6 | ------ | 19.2 | 9.5 | 5.9 | .9 | .9 | 1.0 | 95 | ------ | ------ | ------ |
| .41 | .050 | 8.2 | .9 | ------ | 32.7 | 20.6 | 9.6 | ------ | 24.3 | 8.5 | 8.6 | .5 | [6] 2.9 | 1.9 | 98 | ------ | ------ | ------ |
| .20 | .028 | 7.1 | 1.2 | <1 | 33.5 | 20.5 | 9.9 | ------ | 26.2 | 15.3 | 10.7 | ------ | [6] 4.8 | 2.4 | 100 | ------ | ------ | ------ |
| .18 | .024 | 7.5 | 1.1 | 2 | 31.4 | 20.1 | 8.9 | ------ | 24.1 | 18.4 | 9.7 | ------ | [6] 3.9 | 2.1 | 100 | ------ | ------ | ------ |
| .16 | .019 | 8.4 | .9 | 3 | 26.5 | 16.2 | 8.4 | ------ | 20.7 | 20.8 | 11.5 | ------ | [6] 2.9 | 1.9 | 100 | ------ | ------ | ------ |
| 1.00 | .093 | 10.8 | .4 | ------ | 38.3 | 25.9 | 11.3 | ------ | 25.2 | 12.6 | 6.2 | 3.4 | .5 | 1.7 | 86 | ------ | ------ | ------ |
| .95 | .087 | 10.9 | .4 | ------ | 38.6 | 24.8 | 13.2 | ------ | 29.9 | 15.1 | 7.6 | 3.2 | .4 | 2.0 | 89 | ------ | ------ | ------ |
| .78 | .089 | 8.8 | .5 | ------ | 39.2 | 26.6 | 15.4 | ------ | 32.7 | 17.4 | 10.0 | 3.0 | .4 | 2.0 | 91 | ------ | ------ | ------ |
| .77 | .086 | 9.0 | .4 | ------ | 41.9 | 27.9 | 16.7 | ------ | 36.4 | 18.5 | 12.2 | 3.1 | .6 | 1.6 | 91 | ------ | ------ | ------ |
| .77 | .090 | 8.6 | .4 | ------ | 42.6 | 27.6 | 18.9 | ------ | 47.8 | 22.4 | 17.6 | 2.6 | .7 | 1.9 | 94 | ------ | ------ | ------ |
| ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ | ------ |

TABLE 11.—*Laboratory data on some selected*

| Soil type and profile number | Depth | Horizon | Particle-size distribution | | | | | | | | | | pH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very coarse sand (2.0–1.0 mm.) | Coarse sand (1.0–0.5 mm.) | Medium sand (0.5–0.25 mm.) | Fine sand (0.25–0.10 mm.) | Very fine sand (0.1–0.05 mm.) | Silt (0.05–0.002 mm.) | Clay (less than 0.002 mm.) | Other size classes: 0.2 to 0.02 mm. | Other size classes: 0.02 to 0.002 mm. | Other size classes: Larger than 2 mm. | Saturated paste | 1:10 suspension |
| | *Inches* | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | | |
| Stearns silt loam: S55–Oreg.–7–10. | 0–3 | A21 | .1 | 1.1 | .7 | 4.0 | 10.5 | 72.5 | 11.1 | 46.0 | 40.1 | 0 | 6.8 | 7.8 |
| | 3–5 | A22 | .1 | .4 | .5 | 3.5 | 10.9 | 70.8 | 13.8 | 46.2 | 38.2 | 0 | 7.3 | 8.7 |
| | 5–13 | B2t | .0 | .2 | .5 | 3.9 | 10.4 | 55.6 | 29.4 | 38.9 | 30.2 | 0 | 9.2 | 10.0 |
| | 13–22 | C1m | .1 | 1.2 | 2.3 | 13.6 | 20.4 | 51.8 | 10.0 | 56.1 | 26.8 | 0 | 9.6 | 10.1 |
| | 22–36 | C2m | .3 | 2.2 | 2.8 | 11.0 | 17.7 | 59.7 | 6.3 | 54.9 | 30.2 | 0 | 9.2 | 9.8 |
| | 36–48 | C3 | .2 | 1.5 | 2.6 | 8.3 | 11.6 | 65.1 | 10.7 | 48.8 | 33.0 | 0 | 8.9 | 9.8 |
| | 48–60 | C4 | .2 | 6.8 | 12.9 | 34.2 | 12.6 | 25.8 | 7.5 | 43.4 | 12.5 | 0 | 8.7 | 9.6 |
| Swartz silt loam: S55–Oreg.–7–1. | 0–2 | A1 | .4 | 2.0 | 2.3 | 9.2 | 10.5 | 62.7 | 12.9 | 47.6 | 31.6 | 0 | 6.2 | 6.8 |
| | 2–5 | A2 | .1 | 1.6 | 2.1 | 7.6 | 9.1 | 61.5 | 18.0 | 39.5 | 36.2 | 0 | 6.6 | 7.4 |
| | 5–13 | B21t | .1 | .6 | 1.0 | 2.4 | 1.9 | 31.3 | 62.7 | 17.8 | 16.8 | 0 | 6.6 | 6.9 |
| | 13–22 | B22t | .1 | .9 | 1.2 | 2.7 | 1.9 | 31.4 | 61.8 | 12.7 | 22.1 | 1 | 6.9 | 7.6 |
| | 22–32 | B3t | .1 | .8 | 1.1 | 2.4 | 1.9 | 35.1 | 58.6 | 13.9 | 24.4 | 0 | 7.4 | 7.5 |
| | 32–44 | C1 | .1 | .6 | .8 | 1.9 | 2.1 | 36.9 | 57.6 | 15.0 | 25.2 | 0 | 7.6 | 8.0 |
| | 44–60 | C2 | .0 | .5 | 1.0 | 2.6 | 2.5 | 39.7 | 53.7 | 21.2 | 22.5 | 0 | 7.7 | 7.7 |

[1] Indurated hardpan.
[2] Color of saturation extracts from this profile varied from yellow to dark amber to black.
[3] Exchangeable sodium percentage.

Normally the air movement over the county is from the west and, because the Pacific Ocean is only 150 miles away, the air masses are mostly of marine origin. In their passage over the Coast Range and the Cascade Mountains, however, these masses of air are greatly modified, especially in winter when most of the storms occur and precipitation is heaviest. In winter the ground is much colder than the ocean, and air from off the water is cooled rapidly as it moves over the Coast Range and then, some 50 to 75 miles further, begins its ascent of the Cascades. The air is cooled by contact with the colder ground over which it passes and by its rise up the mountains. The temperature is lowered at the rate of 3° to 5° F. for each 1,000 feet of increase in elevation. Cooling causes the air to give up a large part of the moisture available for precipitation.

As the air moves down the east slopes of the Cascades and passes over the central Oregon plateau, its capacity to hold moisture increases but its content of moisture greatly decreases. In a distance of 30 to 35 miles, from the crest of the Cascades to the western edge of the plateau, the average annual precipitation decreases from more than 65 inches to less than 9 inches. As the air continues to move eastward, it begins to ascend the Ochoco Mountains. The rise in elevation again causes an increase in precipitation, which is substantial on the upper slopes of the mountains.

The Cascade Mountains also have a strong influence on the extremes in temperature that occur on the central Oregon plateau in winter. This influence is exerted in two ways—

(1) Near the surface of the upper eastern slopes, cold air is formed on cold winter nights. Because it is heavy, the cold air moves by gravitation down the mountain slopes to the plateau. Here it accumulates and, by pushing under, forces the preexisting warmer air to ride on top of it. This air movement occurs during periods of calm air or of very light winds. If it persists for several days, a deep pool of stagnant cold air builds up over the plateau. Cold is intensified by a cloud layer that tends to form near the top of the pool and prevents solar heating during the day.

(2) Over the snow and icefields of north-central Canada, masses of cold Arctic air form in winter and generally move southward along the eastern edge of the Rocky Mountains. In most winters, however, segments of Arctic air occasionally break over the Continental Divide. The Cascade Mountains usually are an effective barrier against further movement westward, and the segments are forced to continue southward between the Rocky Mountains and the Cascades. Nearly always the Arctic air is very cold and dry, and usually it causes the lowest temperatures in Crook County and other parts of the central plateau of Oregon. In addition, the heaviest snowfalls on central Oregon occur when a fairly severe storm, consisting of modified marine air, moves in from the west and collides with a mass of cold Arctic air moving down from the north.

Agriculture in Crook County is in three areas that are fairly well defined—the Deschutes plateau, the Crooked River valley and adjacent terraces, and the upper narrow valleys. Although the first two areas have

*soils of the Prineville Area*—Continued

| Organic matter: Organic carbon | Organic matter: Nitrogen | Organic matter: C/N ratio | Electrical conductivity (EC×10³) mmhos. per cm. at 25° C. | $CaCO_3$ equivalent | Moisture held at tensions of— 1/10 atmosphere | Moisture held at tensions of— 1/3 atmosphere | Moisture held at tensions of— 15 atmospheres | Moisture at saturation | Cation exchange capacity (Na) | Extractable cations (meq. per 100 gm.): Ca | Mg | H | Na | K | Base saturation | Saturation extract soluble (meq. per liter): Na | K | Ca +Mg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Percent* | *Percent* | | | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Meq. per 100 gm.* | | | | | | *Percent* | | | |
| 3.25 | .244 | 13.3 | 2.3 | ------ | 58.6 | 36.6 | 20.5 | 55.6 | 31.0 | 10.5 | 4.6 | ----- | 7.7 | 4.9 | [3] 25 | 22.0 | 1.0 | 2.2 |
| 2.40 | .206 | 11.7 | 3.4 | ------ | 54.8 | 38.8 | 22.0 | 54.9 | 34.6 | 10.5 | 4.6 | ----- | 14.1 | 4.5 | [3] 41 | 51.5 | .5 | 2.2 |
| 1.13 | .094 | 12.0 | 9.3 | 1 | 68.1 | 56.1 | 38.6 | 66.6 | 48.7 | 9.7 | 3.6 | ----- | 35.4 | 4.1 | [3] 73 | 82.0 | .7 | 4.1 |
| .42 | .035 | 12.0 | 7.7 | 1 | 56.0 | 41.8 | 26.4 | 52.5 | 42.6 | 14.5 | 2.7 | ----- | 30.0 | 2.1 | [3] 70 | 86.0 | .4 | 3.1 |
| .41 | .037 | 11.1 | 4.0 | 8 | 52.9 | 37.7 | 25.7 | 52.5 | 45.3 | 16.6 | 4.2 | ----- | 27.1 | 1.2 | [3] 60 | 59.5 | .3 | 3.3 |
| .33 | .033 | 10.0 | 2.2 | 2 | 58.0 | 41.6 | 26.1 | 55.2 | 45.4 | 18.9 | 6.6 | ----- | 25.8 | .5 | [3] 57 | 24.6 | .3 | 1.6 |
| .16 | ------ | ------ | 1.1 | 1 | 35.9 | 25.1 | 16.9 | 43.6 | 30.6 | 19.9 | 7.9 | ----- | 10.3 | .2 | [3] 34 | 12.1 | .2 | [7] |
| 1.39 | .115 | 12.1 | .4 | ------ | 37.1 | 29.4 | 7.9 | ------ | 18.8 | 7.0 | 3.8 | 5.5 | .4 | 1.7 | 70 | ------ | ----- | ------ |
| .66 | .058 | 11.4 | .3 | ------ | 33.2 | 27.7 | 8.0 | ------ | 16.9 | 6.8 | 4.2 | 2.7 | .8 | 1.2 | 83 | ------ | ----- | ------ |
| .48 | .046 | 10.4 | .5 | ------ | 75.6 | 57.0 | 39.2 | ------ | 58.7 | 25.1 | 16.6 | 4.2 | 2.8 | 2.6 | 92 | ------ | ----- | ------ |
| .28 | .035 | 8.0 | .4 | ------ | 72.2 | 53.7 | 32.2 | ------ | 54.0 | 24.6 | 16.8 | 3.2 | 3.0 | 2.5 | 94 | ------ | ----- | ------ |
| .20 | .025 | 8.0 | .4 | ------ | 64.1 | 47.1 | 29.0 | ------ | 47.1 | 22.5 | 17.0 | 2.0 | 2.6 | 2.6 | 96 | ------ | ----- | ------ |
| .17 | .020 | 8.5 | .3 | ------ | 64.0 | 46.6 | 27.7 | ------ | 50.0 | 19.8 | 14.2 | 1.4 | 4.1 | 4.2 | 97 | ------ | ----- | ------ |
| .17 | .021 | 88.1 | .3 | ------ | 62.9 | 46.8 | 27.6 | ------ | 49.5 | 26.3 | 11.6 | 1.5 | 3.3 | 2.8 | 97 | ------ | ----- | ------ |

[4] Rhyolite rock.
[5] Weakly to strongly cemented lime-silica hardpan.
[6] 12 to 18 percent is exchangeable sodium.
[7] Trace.

similar climate, temperature and precipitation data are given separately for each area in table 12. The general characteristics of climate in the county are discussed in the following paragraphs.

*Precipitation.*—The average annual precipitation in Crook County ranges from slightly more than 8 inches on the Deschutes plateau to more than 19 inches in the highest parts of the upper valleys used for agriculture. More than half the precipitation falls during the 5 months of October through February, but the amount is proportionately much less than that falling on most of the State during the same period. Showers and thunderstorms produce a significant amount of rainfall from March through June, but only about 10 percent of the yearly precipitation occurs in July, August, and September. On the Deschutes plateau and in the Crooked River valley, on the average, 25 to 35 days a year have as much as 0.10 inch of rainfall per day. In contrast are the upper valleys, where, on the average, 55 to 60 days a year have as much as 0.10 inch of rainfall per day.

At lower elevations much of the precipitation in winter falls as rain. Snow accumulates to a depth of 1 inch or more on only 6 to 8 days a year, and it generally melts in a few hours or, at most, 3 or 4 days. In the upper valleys, however, snow is more abundant, and a depth of as much as 3½ feet has been recorded. In most winters snow at least 15 inches deep can be expected in these valleys, and a depth of 30 inches is not uncommon.

Following short periods of heavy rainfall, rapid runoff causes erosion and creates problems in the design of drainage culverts. Table 13 gives the amount of rainfall, lasting for a specified length of time from 20 minutes to 24 hours, that can be expected once in the return periods indicated. For example, at least once in 2 years, 0.3 inch of rain can be expected to fall during a 20-minute period, but only once in 100 years is it likely that as much as 0.7 inch will fall during a period of 20 minutes. The table was prepared from nomograms in U.S. Weather Bureau Tech. Paper No. 28 (*16*) and is useful in the agricultural areas of the county.

*Temperature.*—Extremes in temperature, recorded at Prineville in the Crooked River valley, range from a low of —35° F. to a high of 119°, which equals the all-time high temperature recorded in the State. A freezing temperature of 32° or lower can be expected in all parts of the county in any month of the year. In table 14 are listed, for the agricultural areas of the county, the probabilities that there will be freezing temperatures of stated intensities in spring after the dates listed and in fall before the dates listed.

*Wind.*—The growing use of airplanes in applying fertilizer, herbicides, and insecticides has led to heightened interest in wind velocities. Wind speed is of interest also because of its influence on the construction of farm buildings and the lodging of uncut hay and grain. Strong easterly winds moving into the county normally bring dry, very cold air in winter and warm, very dry air in summer. These winds in summer deplete soil moisture, rapidly dehydrate vegetation, and often cause a critical danger of fire on forest and grassland.

TABLE 12.—*Temperature and precipitation in three agricultural areas of Crook County*

| Month | Temperature | | | | Precipitation | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average daily | | 2 years in 10 will have at least 4 days with— | | Monthly average | 1 year in 10 will have— | | 2 years in 10 will have— | | 3 years in 10 will have— | | 4 years in 10 will have— | | Average snowfall | Maximum depth of snow on ground | Average number of days with snow cover | Average depth of snow on days with snow cover |
| | Maximum | Minimum | Maximum equal to or higher than— | Minimum equal to or lower than— | | Less than— | More than— | Less than— | More than— | Less than— | More than— | Less than— | More than— | | | | |
| | °F. | °F. | °F. | °F. | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches | | Inches |
| **DESCHUTES PLATEAU** | | | | | | | | | | | | | | | | | |
| January | 42 | 21 | 56 | 2 | 1.1 | 0.4 | 1.9 | 0.5 | 1.5 | 0.6 | 1.3 | 1.0 | 1.2 | 6.6 | 15 | 8 | 4 |
| February | 47 | 25 | 60 | 8 | .8 | .1 | 1.4 | .4 | 1.3 | .4 | 1.1 | .5 | .8 | 3.4 | 9 | 4 | 4 |
| March | 54 | 27 | 69 | 16 | .6 | (1) | 1.3 | .2 | 1.0 | .2 | .7 | .3 | .6 | 1.3 | 5 | 1 | 2 |
| April | 62 | 31 | 78 | 21 | .5 | (1) | 1.2 | .1 | 1.0 | .2 | .7 | .3 | .5 | .7 | 1 | (2) | 1 |
| May | 69 | 37 | 85 | 26 | 1.0 | .2 | 2.2 | .3 | 1.7 | .4 | 1.0 | .6 | .7 | (1) | 1 | (2) | 1 |
| June | 75 | 42 | 90 | 33 | 1.0 | (1) | 2.4 | .2 | 1.9 | .4 | 1.2 | .6 | 1.0 | 0 | 0 | 0 | 0 |
| July | 85 | 47 | 96 | 37 | .3 | 0 | .8 | (1) | .6 | .1 | .4 | .1 | .3 | 0 | 0 | 0 | 0 |
| August | 83 | 45 | 94 | 36 | .2 | 0 | .8 | 0 | .6 | (1) | .3 | (1) | .2 | 0 | 0 | 0 | 0 |
| September | 76 | 40 | 90 | 29 | .5 | (1) | 1.1 | (1) | .8 | .1 | .6 | .2 | .5 | 0 | 0 | 0 | 0 |
| October | 65 | 34 | 81 | 23 | .7 | .1 | 1.5 | .2 | 1.2 | .3 | .9 | .4 | .7 | .2 | 4 | (2) | 2 |
| November | 52 | 28 | 66 | 12 | .9 | .1 | 1.8 | .2 | 1.8 | .4 | 1.3 | .7 | 1.0 | 1.0 | 5 | 1 | 2 |
| December | 45 | 25 | 58 | 9 | 1.1 | .2 | 2.1 | .4 | 1.9 | .4 | 1.3 | .8 | 1.2 | 3.2 | 6 | 2 | 2 |
| Annual | 63 | 33 | [3] 98 | [4] −6 | 8.7 | 5.0 | 12.0 | 6.2 | 10.4 | 7.1 | 9.6 | 8.2 | 9.0 | 16.4 | 15 | 16 | 3 |
| **CROOKED RIVER VALLEY AND TERRACES** | | | | | | | | | | | | | | | | | |
| January | 41 | 19 | 55 | 3 | 1.1 | .4 | 1.9 | .5 | 1.5 | .7 | 1.3 | .9 | 1.2 | 6.3 | 16 | 6 | 4 |
| February | 46 | 24 | 58 | 9 | .8 | .2 | 2.1 | .4 | 1.2 | .5 | .8 | .6 | .7 | 2.9 | 8 | 3 | 3 |
| March | 53 | 26 | 68 | 13 | .7 | .1 | 1.6 | .2 | .9 | .3 | .8 | .4 | .8 | 1.4 | 6 | (2) | 3 |
| April | 62 | 30 | 78 | 19 | .7 | .1 | 1.3 | .2 | 1.1 | .3 | .9 | .7 | .8 | .4 | (5) | (2) | 1 |
| May | 68 | 35 | 83 | 25 | 1.2 | .2 | 2.2 | .4 | 2.1 | .7 | 1.6 | .8 | 1.4 | (1) | (5) | (2) | (5) |
| June | 74 | 40 | 90 | 31 | 1.2 | .1 | 2.9 | .1 | 2.0 | .5 | 1.6 | .8 | 1.4 | 0 | 0 | 0 | 0 |
| July | 85 | 42 | 95 | 34 | .3 | (1) | .8 | (1) | .6 | (1) | .4 | .2 | .3 | 0 | 0 | 0 | 0 |
| August | 83 | 39 | 94 | 31 | .3 | (1) | .8 | (1) | .6 | .1 | .4 | .1 | .2 | 0 | 0 | 0 | 0 |
| September | 77 | 34 | 91 | 24 | .5 | (1) | 1.1 | .1 | .8 | .3 | .6 | .3 | .5 | .1 | 2 | (2) | 2 |
| October | 65 | 30 | 82 | 18 | .8 | .1 | 1.8 | .3 | 1.3 | .5 | 1.0 | .6 | .9 | .3 | 3 | (2) | 2 |
| November | 52 | 25 | 65 | 10 | 1.1 | .2 | 2.3 | .4 | 1.8 | .7 | 1.5 | .8 | 1.4 | .9 | 3 | (2) | 2 |
| December | 44 | 23 | 56 | 8 | 1.1 | .3 | 2.0 | .4 | 1.8 | .5 | 1.5 | .8 | 1.4 | 2.6 | 5 | 2 | 2 |
| Annual | 63 | 31 | [3] 98 | [4] −7 | 9.8 | 6.7 | 13.6 | 7.4 | 12.2 | 8.7 | 11.2 | 9.4 | 10.8 | 14.9 | 16 | 11 | 3 |
| **UPPER NARROW VALLEYS** | | | | | | | | | | | | | | | | | |
| January | 35 | 15 | 45 | −6 | 2.2 | .7 | 3.8 | 1.2 | 2.9 | 1.6 | 2.8 | 1.7 | 2.4 | 19.8 | 43 | 28 | 11 |
| February | 40 | 20 | 49 | 4 | 1.9 | .8 | 3.2 | 1.1 | 2.9 | 1.2 | 2.7 | 1.5 | 1.9 | 14.1 | 36 | 26 | 14 |
| March | 47 | 22 | 62 | 10 | 1.7 | .8 | 2.6 | 1.0 | 2.4 | 1.3 | 2.2 | 1.5 | 2.0 | 11.0 | 34 | 20 | 11 |
| April | 54 | 27 | 73 | 19 | 1.3 | .2 | 2.3 | .5 | 1.9 | .9 | 1.6 | 1.1 | 1.3 | 1.8 | 15 | 1 | 5 |
| May | 64 | 33 | 80 | 24 | 1.9 | .5 | 3.8 | .8 | 3.4 | 1.1 | 2.8 | 1.4 | 2.2 | .4 | 2 | (2) | 2 |
| June | 71 | 37 | 86 | 29 | 1.7 | .1 | 3.7 | .3 | 3.3 | .5 | 2.2 | 1.3 | 2.1 | .1 | 0 | 0 | 0 |
| July | 82 | 41 | 93 | 33 | .8 | (1) | 1.8 | (1) | 1.2 | .1 | .7 | .4 | .5 | (1) | 0 | 0 | 0 |
| August | 81 | 39 | 92 | 31 | .6 | 0 | 1.6 | (1) | 1.1 | .1 | 1.0 | .2 | .7 | 0 | 0 | 0 | 0 |
| September | 75 | 35 | 89 | 26 | .8 | .1 | 1.6 | .2 | 1.3 | .4 | .9 | .6 | .9 | .2 | 0 | 0 | 0 |
| October | 60 | 30 | 78 | 22 | 1.8 | .2 | 3.8 | .8 | 3.0 | .9 | 2.4 | .1 | 1.7 | 1.3 | 5 | 1 | 3 |
| November | 44 | 24 | 57 | 11 | 2.3 | .6 | 4.8 | .9 | 3.5 | 1.1 | 2.8 | 1.9 | 2.6 | 7.1 | 14 | 8 | 4 |
| December | 37 | 20 | 47 | 5 | 2.6 | 1.1 | 5.1 | 1.4 | 4.5 | 1.6 | 2.8 | 1.9 | 2.3 | 13.4 | 26 | 18 | 8 |
| Annual | 58 | 29 | [3] 96 | [4] −11 | 19.3 | 13.7 | 25.4 | 14.8 | 23.9 | 16.5 | 20.9 | 18.7 | 20.0 | 69.2 | 43 | 102 | 11 |

[1] Trace.
[2] Less than half a day.
[3] Average annual highest temperature.
[4] Average annual lowest temperature.
[5] Less than 0.5 inch.

TABLE 13.—*Amount of rainfall of stated duration to be expected once in the specified number of years*

| Duration | Return period of— | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 years | 5 years | 10 years | 25 years | 50 years | 75 years | 100 years |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 20 minutes | 0. 3 | 0. 4 | 0. 5 | 0. 5 | 0. 6 | 0. 7 | 0. 7 |
| 30 minutes | . 4 | . 4 | . 5 | . 7 | . 8 | . 8 | . 9 |
| 1 hour | . 4 | . 6 | . 7 | . 8 | . 9 | 1. 0 | 1. 1 |
| 2 hours | . 6 | . 8 | . 8 | 1. 0 | 1. 2 | 1. 2 | 1. 4 |
| 3 hours | . 8 | . 9 | 1. 1 | 1. 3 | 1. 5 | 1. 6 | 1. 7 |
| 6 hours | 1. 0 | 1. 3 | 1. 4 | 1. 7 | 1. 8 | 1. 9 | 2. 0 |
| 12 hours | 1. 3 | 1. 6 | 1. 8 | 2. 0 | 2. 3 | 2. 4 | 2. 5 |
| 24 hours | 1. 5 | 1. 8 | 2. 1 | 2. 4 | 2. 7 | 2. 9 | 3. 0 |

Table 15 and figure 12 give data on wind velocities based on hourly observations at the Redmond Airport, Deschutes County, during a period of 4½ years. Prevailing wind at the airport is from the west to northwest most of the year, but it is from the south to southeast late in fall and early in winter.

*Humidity*.—The relative humidity rises during the night because the air is cooled while its content of water vapor remains constant. At 4:00 a.m., the relative humidity is highest and, on the average, is 75 to 80 percent throughout the year. At 4:00 p.m., the humidity generally is lowest for the day and, on the average, ranges from a high of 65 to 70 percent in December to a low of 20 to 25 percent in July. If winds are fairly strong from the east or southeast, the relative humidity may fall as low as 8 to 10 percent during the day. In periods of highest temperature, discomfort is minimized by low relative humidity. Table 16 shows the average relative humidity, by months, recorded four times a day at the Redmond Airport, Deschutes County. Records are incomplete for agricultural areas in Crook County, but data in table 16 are considered representative.

*Thunderstorms*.—Most of the precipitation in summer accompanies infrequent thunderstorms that bring light rainfall and, at times, hail. These storms are more frequent at the higher elevations. On the Deschutes plateau and in the Crooked River valley, 6 to 12 storms occur annually, but in the upper valleys of the Ochoco Mountains, 15 to 25 storms occur each year. Particularly hazardous are the dry thunderstorms that bring lightning and thunder but no rain. At times, lightning ignites grass, brush, and timber, and fires spread unchecked because moisture is lacking.

*Hail*.—A few hailstorms occur each year, but in most years they cause little or no damage. In only a few years have storms brought hail that caused fairly heavy losses in small local areas. In Crook County, there is no record of hailstorms that were widespread and severe enough to affect the economy.

*Tornadoes*.—True tornadoes are almost unknown in Oregon, and none has been recorded in Crook County. On a warm day in summer, several dust devils may develop that are a few feet to 10 or 15 yards in diameter and extend upward as much as 2,000 to 3,000 feet. In contrast to a tornado, which extends from a cloud downward, a dust devil begins at the ground and gradually rises. Dust



TABLE 14.—*Probabilities of last freezing temperatures in spring and first in fall*

| Probability | Dates for given probability and temperature | | | |
|---|---|---|---|---|
| | 16° or lower | 20° or lower | 24° or lower | 28° or lower |
| DESCHUTES PLATEAU | | | | |
| Spring: | | | | |
| 1 year in 10, later than. | Apr. 5 | Apr. 25 | May 21 | June 5 |
| 2 years in 10, later than. | Mar. 29 | Apr. 18 | May 14 | May 29 |
| 5 years in 10, later than. | Mar. 16 | Apr. 5 | May 1 | May 16 |
| Fall: | | | | |
| 1 year in 10, earlier than. | Oct. 28 | Oct. 11 | Sept. 28 | Sept. 7 |
| 2 years in 10, earlier than. | Nov. 4 | Oct. 18 | Oct. 5 | Sept. 14 |
| 5 years in 10, earlier than. | Nov. 17 | Oct. 31 | Oct. 18 | Sept. 27 |
| CROOKED RIVER VALLEY | | | | |
| Spring: | | | | |
| 1 year in 10, later than. | Apr. 27 | May 3 | May 26 | June 16 |
| 2 years in 10, later than. | Apr. 17 | Apr. 27 | May 20 | June 10 |
| 5 years in 10, later than. | Mar. 29 | Apr. 16 | May 9 | May 30 |
| Fall: | | | | |
| 1 year in 10, earlier than. | Oct. 9 | Sept. 20 | Sept. 3 | Aug. 16 |
| 2 years in 10, earlier than. | Oct. 16 | Sept. 27 | Sept. 11 | Aug. 22 |
| 5 years in 10, earlier than. | Oct. 29 | Oct. 10 | Sept. 22 | Sept. 4 |
| UPPER NARROW VALLEYS | | | | |
| Spring: | | | | |
| 1 year in 10, later than. | Apr. 18 | May 10 | June 4 | June 28 |
| 2 years in 10, later than. | Apr. 11 | May 3 | May 29 | June 22 |
| 5 years in 10, later than. | Mar. 29 | Apr. 20 | May 15 | June 10 |
| Fall: | | | | |
| 1 year in 10, earlier than. | Oct. 14 | Sept. 26 | Sept. 5 | Aug. 14 |
| 2 years in 10, earlier than. | Oct. 23 | Oct. 5 | Sept. 14 | Aug. 23 |
| 5 years in 10, earlier than. | Nov. 9 | Oct. 22 | Oct. 1 | Sept. 9 |

devils occasionally overturn a small, lightly constructed farm building and may damage a roof or an awning, but they do not affect a substantial structure.

## History

Crook County was formed in 1882 from a part of old Wasco County. It was named for George Crook, a major general in the U.S. Army and an early pioneer and ex-

TABLE 15.—*Percentage of time, for a 12-month period, that wind velocity falls within given velocity ranges*

[Data based on hourly observations at Redmond Airport, Deschutes County, during a period of 4½ years]

| Month | Velocity in miles per hour | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 1 to 3 | 4 to 7 | 8 to 12 | 13 to 18 | 19 to 24 | 25 to 38 |
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| January | 8 | 4 | 34 | 23 | 21 | 7 | 3 |
| February | 14 | 5 | 42 | 19 | 15 | 3 | 1 |
| March | 9 | 6 | 43 | 21 | 17 | 4 | (1) |
| April | 10 | 6 | 43 | 21 | 16 | 3 | (1) |
| May | 11 | 6 | 43 | 24 | 14 | 2 | (1) |
| June | 12 | 9 | 39 | 26 | 13 | 1 | (1) |
| July | 10 | 5 | 47 | 26 | 11 | 1 | (1) |
| August | 10 | 6 | 50 | 25 | 8 | 1 | (1) |
| September | 14 | 6 | 48 | 23 | 7 | 1 | (1) |
| October | 11 | 8 | 48 | 21 | 10 | 2 | 1 |
| November | 11 | 6 | 41 | 24 | 16 | 1 | 1 |
| December | 12 | 5 | 38 | 23 | 17 | 3 | 1 |

[1] Less than 0.5 percent.

plorer. At one time the county consisted of the territory that is now Crook, Wheeler, Jefferson, and Deschutes Counties, and it had a total area of 6,068,560 acres. The county later was subdivided to form Wheeler County in 1899, Jefferson County in 1914, and Deschutes County in 1916.

The city of Prineville was named for Barney Prine, who had established a claim near the confluence of Ochoco Creek and the Crooked River. Prineville was built near the site of the claim and was incorporated by the State legislature in 1880.

The agricultural history of the county is one of livestock and grazing. Although farming became more diversified when irrigation water was made available in 1914, and after roads and transportation systems were improved, agriculture still is geared to the raising of livestock and the production of alfalfa hay and irrigated pasture. Small grain and potatoes are important cash crops. A common system of diversified farming consists of livestock, hay, and potatoes.

TABLE 16.—*Average relative humidity by month and time of day*

[Based on records at Redmond Airport, Deschutes County]

| Month | Time of day | | | |
|---|---|---|---|---|
| | 4:00 a.m. | 10:00 a.m. | 4:00 p.m. | 10:00 p.m. |
| | *Percent* | *Percent* | *Percent* | *Percent* |
| January | 74 | 64 | 62 | 74 |
| February | 80 | 64 | 54 | 77 |
| March | 75 | 52 | 44 | 66 |
| April | 72 | 39 | 32 | 61 |
| May | 77 | 43 | 34 | 64 |
| June | 80 | 44 | 35 | 61 |
| July | 74 | 32 | 22 | 49 |
| August | 72 | 38 | 29 | 55 |
| September | 70 | 38 | 28 | 54 |
| October | 79 | 50 | 42 | 67 |
| November | 75 | 59 | 54 | 73 |
| December | 79 | 67 | 66 | 82 |
| Year | 75 | 49 | 42 | 65 |

## Population

According to the U.S. Census of Population, the total population of the county was 9,430 in 1960. About half this number lived in or near Prineville, and possibly three-fourths lived within the survey area. In 1960, the city of Prineville, the principal city and county seat, had a population of 3,263. The community of Prineville Southeast had a population of 1,299.

## Transportation and Markets

The Area is well supplied with all-weather, surfaced or gravel roads. The City of Prineville operates a short-line railroad that connects the Area with major railroads. U.S. Highway No. 26, running east and west, passes through Prineville and connects with U.S. Highway No. 97, a principal highway crossing the State in a north-south direction. Daily bus and airline services are provided. Trucking lines maintain fast, reliable service to points within and outside the State.

Portland is the chief market for livestock, potatoes, and grain. The Willamette Valley is the principal market for hay.

## Water Supply

The sources of water on farms in the Prineville Area are wells, streams, and ditches used for irrigation. East of the Crooked River, wells supply the only water for human use, and streams furnish water for irrigation. In the valley at Prineville there are artesian wells that supply water of generally satisfactory quality. On the basaltic upland plateau west of the Crooked River, the water used for irrigation is also used for livestock and domestic purposes. In this area the domestic supply is stored in cisterns and generally is chlorinated.

Wells have been drilled through the massive basaltic lava flows in the area of Powell Butte, but only a few of these were successful before 1956. Later the number of successful wells increased enough to supply adequate water for domestic use. In the Powell Butte area, water used for irrigation, livestock, and domestic purposes is carried in irrigation canals of the Central Oregon Irrigation District. These canals bring an adequate supply of good water from snow melting high on the east slopes of the Cascade Mountains, some 50 miles away.

## Land Use

In Crook County, 72,228 acres are classified as cultivated land, 1,231,095 acres are grazing land, and 592,810 acres are timberland. About 55,100 acres of the arable soils in the county are irrigated, and about three-fourths of this acreage is in the survey area. Of the irrigated acreage, 23,400 acres are managed by irrigation districts, and 31,700 acres are under private management. About 17,128 acres in the county are dryfarmed, but most dry-farming is outside the survey area.

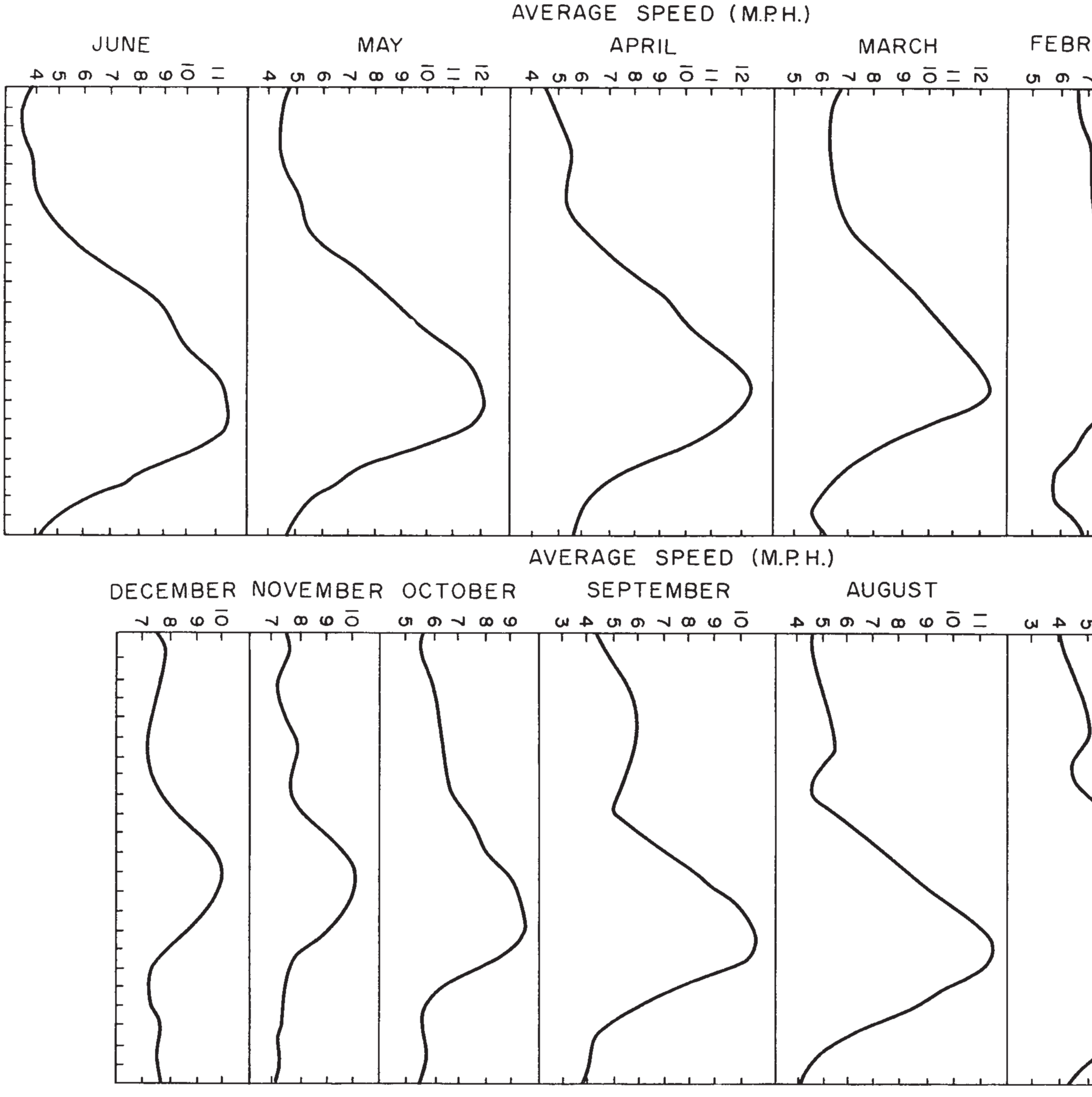


*Figure 12.*—**Average hourly wind velocities, by months, on the Deschutes Plateau.**

Of the total acreage grazed, 733,238 acres are privately owned, and 497,857 acres are chiefly in the public domain and partly in State or county ownership. Of the total acreage of timberland, 129,978 acres are privately owned, and 462,832 acres are in national forest.

## Type and Size of Farms

Although the exact number of farms in the Prineville Area is not known, it is estimated that the Area has three-fourths of the total irrigated cropland in the county. According to the U.S. Census of Agriculture, the farms in the county average 2,639 acres in size. In this Area the average-size farm in the irrigated communities of Powell Butte, Lone Pine, and Prineville is about 120 acres.

## Livestock

In 1954, about 51.2 percent of the total agricultural income in Crook County, excluding income from timber sales, was derived from the sale of livestock and livestock products. Livestock in the county number more than 50,000 beef cattle, 2,000 dairy cattle, 15,000 sheep, 2,000 hogs, and 2,200 horses.

The Ochoco National Forest annually furnishes pasture for about 15,000 sheep and 20,000 cattle. Much of the rangeland outside the national forest, including range administered by the U.S. Bureau of Land Management, furnishes pasture for about 35,000 cattle.

Crook County is among the important livestock-feeding districts in the State. The animals are fed hay, grain, and cull potatoes grown locally. In summer many of the cattle graze on the national forest or on irrigated pasture in the survey area.

For almost 100 years, the raising of beef cattle has been the major agricultural enterprise in the county. Soils in the survey area have been used mainly for producing hay to supply feed in winter and for growing supplemental pasture in summer. The principal breeds of cattle are Hereford, Shorthorn, and Angus. Cattle are sold to local buyers and then shipped to Portland. Because of the increase in acreage and production of alfalfa, feeding dry hay to feeder calves is now common.

Many small flocks of sheep are kept on irrigated farms. The Area is important in winter as a feeding area for bands of sheep that graze on the national forest in summer. The most common breeds of sheep are Rambouillet, Columbia, and Hampshire.

## Crops

Table 17 gives the acreage and production of the principal crops, based on the U.S. Census of Agriculture. Because the survey area contains most of the irrigated soils in the county, the figures listed for crops grown under irrigation—alfalfa, potatoes, small grain, pasture, and others—are acceptable for the area surveyed.

The principal crops grown in the Prineville Area, in order of decreasing total acreage, are alfalfa for hay, grasses and legumes for irrigated pasture, wheat for grain, barley for grain, and potatoes. Somewhat less important cash crops are small grain for hay, oats for grain, rye for grain, mixed hay, and wild hay. Also grown are strawberries, berries, and onions, and alfalfa, potatoes, clover, and grass for seed.

*Alfalfa.*—Since 1914 there has been a steady though fluctuating increase in the acreage of alfalfa. This is the principal hay crop in the Area and is grown throughout the irrigated part. The average yield is about 3 tons per acre, but 4 to 6 tons per acre are common. Alfalfa generally follows small grain in a 6- to 8-year rotation that consists of potatoes for 1 or 2 years, small grain for 1 year, and alfalfa for 4 or 5 years. Because soils in the Area generally are deficient in sulfur, applying sulfur in the form of gypsum is a common practice. Adding phosphorus increases yields. The Ladak and Ranger varieties are superior to either common or Grimm, and the Orestan variety shows promise. Most of the alfalfa cut for hay is baled and stacked in the field, but some is chopped. Two cuttings, and occasionally three, are obtained each year. Most of the hay is fed on the farm, but 10 to 20 percent of it is shipped out of the county, mainly to dairy farms in the Willamette Valley.

*Potatoes.*—Following improvement in transportation in the survey area, potatoes became one of the chief cash crops. The City of Prineville Railroad, which connects Prineville with the major railroads, handles most of the shipping. Potatoes are grown on most of the irrigated soils in the survey area, but their position in the economy is not quite so high as in adjoining Deschutes and Jefferson Counties.

Although yields of potatoes vary considerably because of differences in soil characteristics and management, the average yield under good management is about 400 bushels per acre. Yields are slightly higher on the high terraces and alluvial fans north of Prineville than in the community of Powell Butte and, because of freezes late in spring and early in fall, they are lower on the sandy soils in Dry River Canyon. Growing potatoes on many of the bottom lands is not feasible, because drainage is not adequate.

Potatoes are not produced commercially on dryland soils. On irrigated soils they are commonly grown in a rotation with 2 to 5 years of alfalfa, pasture, or clover. Potatoes can be grown in the same field 2 years in succession if a green-manure crop is used. The potatoes are planted by machine in May and are placed 9 to 12 inches apart in rows that are 30 inches apart. The average rate of planting is 16 to 20 sacks of seed potatoes per acre. Generally a complete fertilizer is applied at a rate per acre of 100 pounds of nitrogen, 75 pounds of phosphoric acid ($P_2O_5$), 75 pounds of potash ($K_2O$), and 300 pounds of gypsum. Irrigation is by the furrow method, but the amount and rate of irrigation are highly variable. Experimental data on the water requirements of potatoes indicate that 12 to 16 acre-inches of water are needed for a crop. However, three to four times that amount is commonly used. On many farms potatoes are stored in cellars until they are graded and sold. Among the common varieties are the Netted Gem and Russett Burbank. Producing potatoes for certified seed is a profitable and specialized enterprise that has increased in importance since 1940.

*Small grain.*—Most of the wheat is grown on irrigated soils, but some is on nonirrigated soils near Grizzly

TABLE 17.—*Acreage and production of principal crops in Crook County, Oreg.*

| Crop | 1949 | | 1954 | | 1959 | |
|---|---|---|---|---|---|---|
| | *Acres* | *Bu.* | *Acres* | *Bu.* | *Acres* | *Bu.* |
| Wheat, threshed or combined: | | | | | | |
| Winter wheat | 887 | 16, 924 | 2, 894 | 132, 950 | 1, 569 | 68, 757 |
| Spring wheat | 2, 854 | 54, 293 | 1, 511 | 50, 131 | 775 | 25, 001 |
| Barley, threshed or combined | 6, 248 | 260, 411 | 3, 942 | 178, 191 | 3, 054 | 114, 297 |
| Oats, grown alone, threshed or combined | 2, 167 | 77, 243 | 1, 172 | 44, 811 | 893 | 42, 564 |
| | | *Tons* | | *Tons* | | *Tons* |
| Hay crops, total | 30, 656 | 48, 261 | 34, 794 | 667, 623 | 37, 329 | 71, 689 |
| Alfalfa and alfalfa mixtures cut for hay | 8, 826 | 20, 575 | 12, 822 | 38, 775 | 13, 310 | 39, 434 |
| Clover, timothy, and mixture of clover and grasses cut for hay | 656 | 1, 097 | 1, 684 | 3, 290 | 3, 117 | 6, 025 |
| Oats, wheat, barley, rye, or other small grain cut for hay | 11, 313 | 14, 787 | 10, 933 | 13, 450 | 6, 996 | 8, 678 |
| Wild hay cut | 8, 601 | 10, 148 | 8, 416 | 11, 405 | 10, 365 | 12, 923 |
| Other hay cut | 1, 260 | 1, 654 | 939 | 703 | 3, 541 | 4, 629 |
| Seed: | | *Lb.* | | *Lb.* | | *Lb.* |
| Alfalfa | 5 | 761 | 10 | 600 | (1) | (1) |
| Red clover | 195 | 24, 053 | 60 | 12, 300 | 16 | 1, 000 |
| Austrian winter peas | 219 | 362, 743 | 10 | 6, 000 | (1) | (1) |
| Ladino clover | 415 | 60, 868 | 80 | 10, 000 | (1) | (1) |
| Alsike clover | 485 | 86, 524 | 500 | 117, 174 | 212 | 52, 500 |
| Potatoes | 4, 125 | 96, 533, 900 | 2, 581 | 64, 908, 800 | 2, 216 | 52, 303, 800 |

[1] Not reported.

Butte and on the alluvial fans above Mill Creek. Irrigated wheat follows potatoes in the rotation in order to obtain use of the fertilizer carried over from the potato crop. At times wheat is planted in spring as a nurse crop for legumes, though yields generally are 20 to 30 percent lower than if wheat is used alone. Barley and oats also are grown in rotation with potatoes and alfalfa and are commonly used as nurse crops for legumes.

*Clover.*—On irrigated soils in the Area, alsike and Ladino clovers grown for seed are important cash crops. Yields range from 200 to 800 pounds of seed per acre. Experimental tests have shown that 1,000 pounds of clean seed could be harvested per acre if harvesting methods were more efficient. Fertilization is about the same for clover as for alfalfa.

*Irrigated pasture.*—Irrigated pasture is chiefly on soils that are shallow, stony, sloping, steep, or imperfectly drained. On the stony soils, most permanent pasture that is irrigated consists of bluegrass and white clover. On the better soils, irrigated pasture is commonly grown in a 6- to 8-year rotation. Commonly seeded is a mixture of alta fescue or orchardgrass and clover; alta fescue, orchardgrass, and alfalfa; or alta fescue, meadow foxtail, and clover. Nitrogen, sulfur, and phosphate fertilizers are used at an annual rate per acre of about 120 pounds of nitrogen, 50 pounds of sulfur, and 50 pounds of phosphate. The time of application is important in obtaining the best growth. A split application is most suitable—half before April 1 and half about June 1.

## Rangeland

Most areas of rangeland are covered mainly by big sagebrush, bunchgrasses, cheatgrass, and juniper. On much of the acreage there is considerable rabbitbrush that has invaded abandoned cropland and overgrazed range. In the eastern foothills, bitterbrush and such bunchgrasses as Idaho fescue and bluebunch wheatgrass occur with big sagebrush. Ponderosa pine, bitterbrush, and bunchgrasses are in the Ochoco Mountains. The principal grasses in the Prineville Area are bluebunch wheatgrass, Idaho fescue, needlegrasses, and Sandberg bluegrass.

A large part of the range is in poor condition because cheatgrass and rabbitbrush have replaced the more palatable grasses and brush. Wet meadows have been fertilized in some places, and crested wheatgrass has been planted in some range areas. The range is commonly grazed in spring and fall under a system of rotation-deferred grazing that helps in reestablishing and maintaining the perennial grasses.

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## Glossary

**Aggregate, soil.** Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

**Alkali soils.** Generally, a highly alkaline soil. Specifically, a soil that has so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or higher), or both, that the growth of most crop plants is reduced.

**Alkaline soil.** Generally, a soil that is alkaline throughout most or all of that part of it occupied by plant roots, but the term is commonly applied to only a specific layer or horizon of a soil. Precisely, any soil horizon having a pH value greater than 7.0; practically, a soil having a pH above 7.3.

**Alluvial fan.** Soil material laid down by water in a fan- or cone-shaped deposit at the base of a mountain.

**Alluvium.** Soil materials deposited on land by streams.

**Bottom land.** Nearly level land occupying the bottom of the valley of a present stream and subject to flooding unless protected artificially.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

**Cementation (soil materials).** A brittle, hardened consistence caused by a cementing substance other than clay minerals, such as lime, silica, iron, or alumina. Typically, the cementation is changed little if any by moistening, and the hardness or brittleness persists in the wet condition. Some cementing agents resist moistening but soften under prolonged wetting and give rise to soil layers in which the cementation is strong when dry but is very weak when wet. Some layers cemented with lime soften readily upon wetting. Unless otherwise stated, cementation descriptions imply little alteration, if any, by wetting. Relative terms used are as follows:

*Weakly cemented.*—Cemented mass is brittle and hard, but it can be broken in the hands.

*Strongly cemented.*—Cemented mass is brittle and hard; it cannot be broken in the hands but is easily broken with a hammer.

*Indurated.*—Very strongly cemented, brittle; does not soften under prolonged wetting and is so extremely hard that a sharp blow with a hammer is required for breakage; hammer generally rings as a result of the blow.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Some of the terms commonly used to describe consistence are—

*Loose.*—Noncoherent; soil does not hold together in a mass.

*Friable.*—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together in a lump.

*Firm.*—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; forms a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

*Hard.*—When dry, soil is moderately resistant to pressure but is difficult to break between thumb and forefinger.

*Soft.*—When dry, soil breaks into powder or individual grains under very slight pressure.

**Drainage, soil.** (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, soil drainage refers to the frequency and duration of periods when the soil is free of saturation. For example, in well-drained soils, the water is removed readily but not rapidly; in poorly drained soils, the root zone is waterlogged for long periods and the roots of ordinary crop plants cannot get enough oxygen; and in excessively drained soils, the water is removed so completely that most crop plants wither from lack of water.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes and that differs in one or more ways from adjacent horizons in the same profile.

**Inclusions.** Areas of soil that are too small to be shown separately on a map of the scale used and are, therefore, mapped with a soil of a different type or phase.

**Irrigability.** The relative ease or difficulty of leveling and grading the soil and distributing irrigation water. The terms used in this report are: *Very easy, easy, slightly difficult, difficult, very difficult,* and *not suitable.*

**Leaching.** The removal of material in solution by water passing through soil.

**Lime.** Lime from the strictly chemical standpoint refers to only one compound, calcium oxide (CaO). However, the term lime is commonly used in agriculture to include a great variety of materials that are generally composed of the oxide, hydroxide, or carbonate of calcium, or of calcium and magnesium. The most commonly used forms of agricultural lime are ground limestone (carbonates), hydrated lime (hydroxides), burnt lime (oxides), marl, and oystershells.

**Loam.** Soils that contain 7 to 27 percent clay, 23 to 50 percent silt, and less than 52 percent sand.

**Moisture-holding capacity.** The capacity of the soil to hold moisture that will not drain away but that can be taken up by plant roots. Relative terms are *low, moderate, high,* and *very high.*

**Mottled.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.*

**Pan.** A layer in a soil that is firmly compacted or very rich in clay. Frequently the word "pan" is combined with other words that more explicitly indicate the nature of the layers, for example, *hardpan, claypan,* and *traffic pan.*

**Parent material (soil).** The horizon of weathered rock or partly weathered soil material from which soil has formed.

**Permeability, soil.** The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

**Profile, soil.** A vertical section of the soil through all its horizons and extending into the parent material. (See also Horizon, soil.)

**Pumice.** An excessively cellular, glassy lava, generally of the composition of rhyolite. It is a sort of volcanic froth, generally whitish or grayish in color, that is very light and will float on water.

**Pumiceous soil.** Soil that has developed from pumice.

**Reaction, soil.** The degree of acidity or alkalinity of the soil, expressed in pH values or in words, as follows:

| | *pH* | | *pH* |
|---|---|---|---|
| Extremely acid | Below 4.5 | Mildly alkaline | 7.4 to 7.8 |
| Very strongly acid | 4.5 to 5.0 | Moderately alkaline | 7.9 to 8.4 |
| Strongly acid | 5.1 to 5.5 | Strongly alkaline | 8.5 to 9.0 |
| Medium acid | 5.6 to 6.0 | Very strongly alkaline | 9.1 and higher |
| Slightly acid | 6.1 to 6.5 | | |
| Neutral | 6.6 to 7.3 | | |

**Runoff.** The removal of water by flow over the surface of the soil. The amount and rapidity of surface runoff are affected by the texture, structure, and porosity of the surface layer, by the vegetative covering, by the prevailing climate, and by the slope. The rate of surface runoff is expressed as follows: *Ponded, very slow, slow, medium, rapid,* and *very rapid.*

**Sand.** (1) Individual rock or mineral fragments having diameters ranging from 0.05 millimeter to 2.0 millimeters. Sand grains consist chiefly of quartz, but they may be of any mineral composition. (2) As a soil textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

**Silt.** (1) Individual mineral particles of soil that range in diameter from 0.002 millimeter to 0.05 millimeter. (2) As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Slope, soil.** The incline of the surface of a soil. It is usually expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance. The slope classes used in this report are:

| | *Percent* | | *Percent* |
|---|---|---|---|
| Nearly level | 0 to 2 | Moderately sloping | 12 to 20 |
| Gently sloping | 2 to 6 | Steep | 20 to 40 |
| Sloping | 6 to 12 | Very steep | 40 to 70 |

**Sodic soil.** A soil containing a harmful concentration of sodium.

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate, and living matter acting on parent material, as conditioned by relief over periods of time.

**Stripcropping.** Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind or water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles, or clusters, that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*blocky, columnar, granular, platy,* and *prismatic.* Structureless soils are single grain (each grain by itself, as in dune sand) or massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

*Angular blocky.*—Aggregates are shaped like blocks; they may have flat or rounded surfaces that join at sharp angles.

*Subangular blocky.*—Aggregates have some rounded and some flat surfaces; upper sides are rounded.

*Columnar.*—Aggregates are prismatic and are rounded at the top.

*Granular.*—Aggregates are roughly spherical, small, and relatively nonporous, but they do not have the distinct faces of blocky structure.

*Platy.*—Aggregates are flaky or platelike.

*Prismatic.*—Aggregates have flat vertical surfaces, and their height is greater than their width.

**Subsoil.** In many soils, the B horizon; roughly, the part of the profile below plow depth and above the parent material.

**Surface soil.** Technically, the A horizon; commonly, the upper part of arable soils stirred by tillage implements, or an equivalent depth (5 to 8 inches) in nonarable soils.

**Terrace (geology).** A nearly level or gently undulating plain that occurs along a stream valley and is intermediate in elevation between the flood plain and the upland. Terraces are remnants of an earlier flood plain of the stream.

**Texture, soil.** The relative proportions of the various size groups of individual soil grains in a mass of soil; specifically, the proportions of sand, silt, and clay. (See also Sand, Silt, and Clay.)

**Underlying material.** Any layer beneath the solum, or true soil. It applies to the parent material and to layers unlike the parent material that lie below the B horizon, or subsoil.

**Upland (geology).** Land consisting of material unworked by water in recent geologic time and generally at a higher elevation than the alluvial plain or stream terrace; land above the lowlands along rivers or between hills.

**Vesicular.** Having many holes or air pockets (like a sponge). Characteristic of the pumice and basalt in the Prineville Area.

**Workability.** The relative ease or difficulty of tilling the soil and harvesting the crops. The terms used in this report are: *Very easy, easy, slightly difficult, difficult, very difficult,* and *impractical.*

U.S. GOVERNMENT PRINTING OFFICE: 1966

# Accessibility Statement

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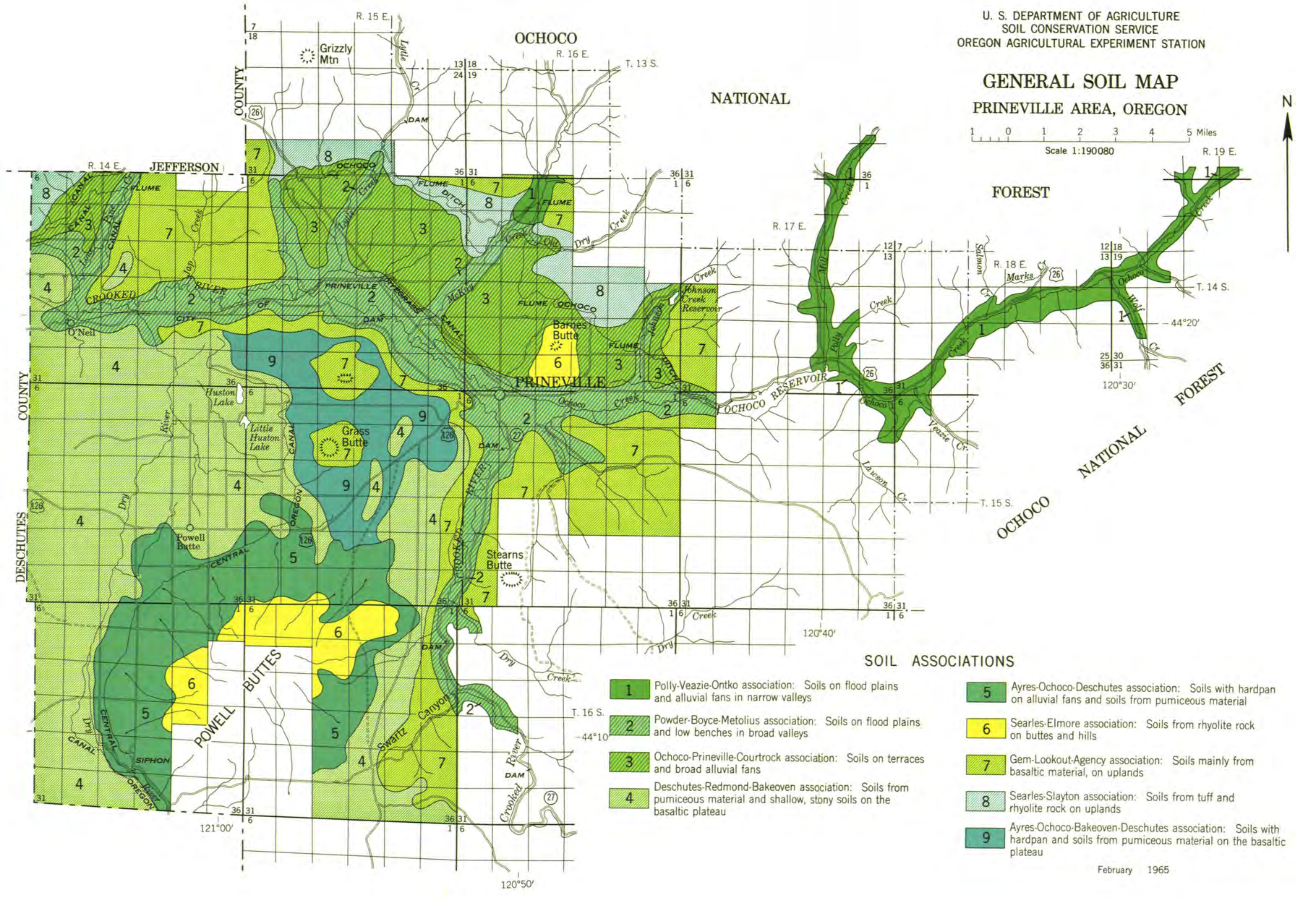

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OREGON AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
PRINEVILLE AREA, OREGON
Scale 1:190080
1 0 1 2 3 4 5 Miles
N
SOIL ASSOCIATIONS
1 Polly-Veazie-Ontko association: Soils on flood plains and alluvial fans in narrow valleys
2 Powder-Boyce-Metolius association: Soils on flood plains and low benches in broad valleys
3 Ochoco-Prineville-Courtrock association: Soils on terraces and broad alluvial fans
4 Deschutes-Redmond-Bakeoven association: Soils from pumiceous material and shallow, stony soils on the basaltic plateau
5 Ayres-Ochoco-Deschutes association: Soils with hardpan on alluvial fans and soils from pumiceous material
6 Searles-Elmore association: Soils from rhyolite rock on buttes and hills
7 Gem-Lookout-Agency association: Soils mainly from basaltic material, on uplands
8 Searles-Slayton association: Soils from tuff and rhyolite rock on uplands
9 Ayres-Ochoco-Bakeoven-Deschutes association: Soils with hardpan and soils from pumiceous material on the basaltic plateau
February 1965
OCHOCO NATIONAL FOREST
OCHOCO NATIONAL FOREST
JEFFERSON COUNTY
DESCHUTES COUNTY
PRINEVILLE
OCHOCO RESERVOIR
POWELL BUTTES
Grizzly Mtn
Barnes Butte
Grass Butte
Stearns Butte
Powell Butte
O'Neil
Huston Lake
Little Huston Lake
Johnson Creek Reservoir
CROOKED RIVER
R. 14 E.
R. 15 E.
R. 16 E.
R. 17 E.
R. 18 E.
R. 19 E.
T. 13 S.
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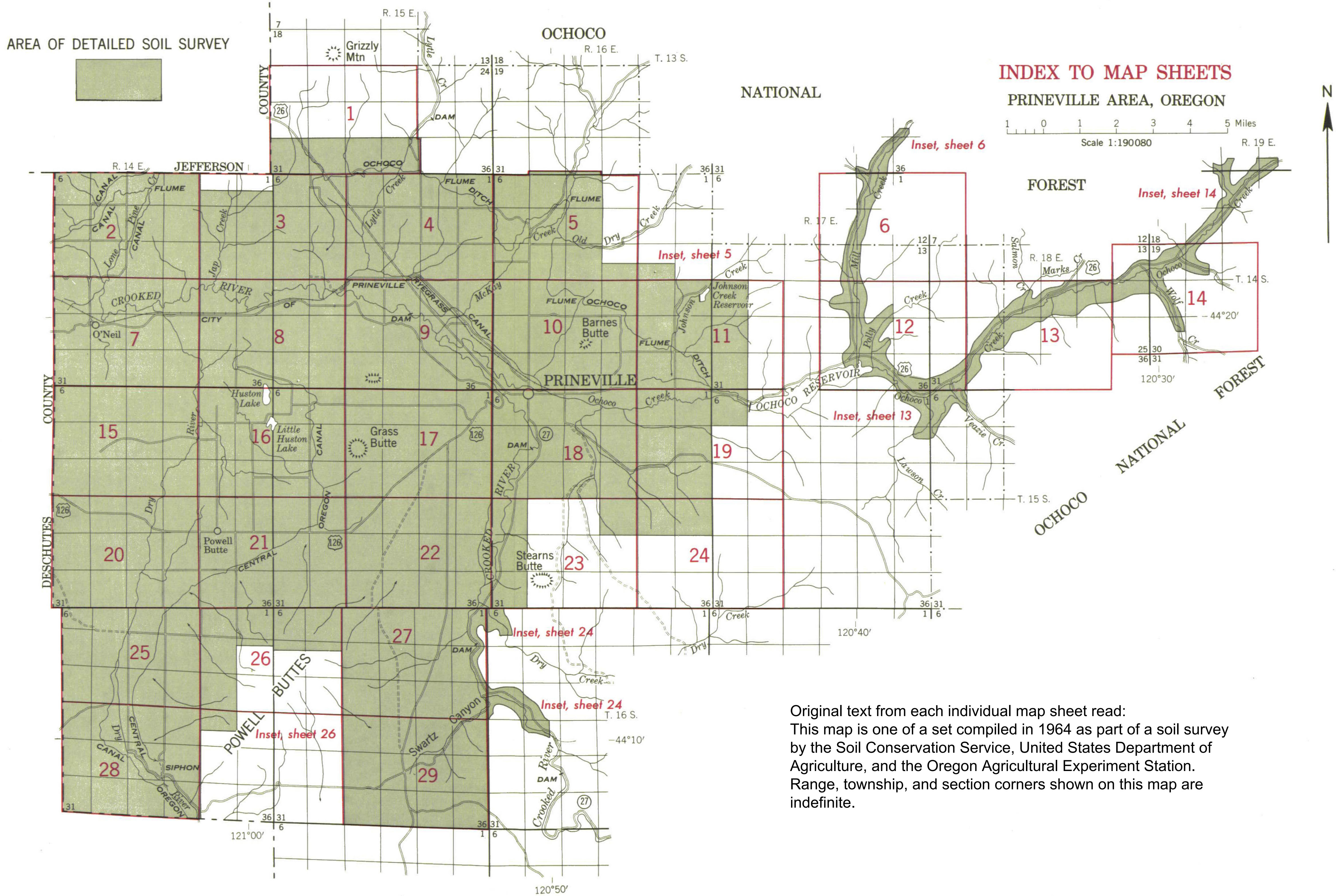
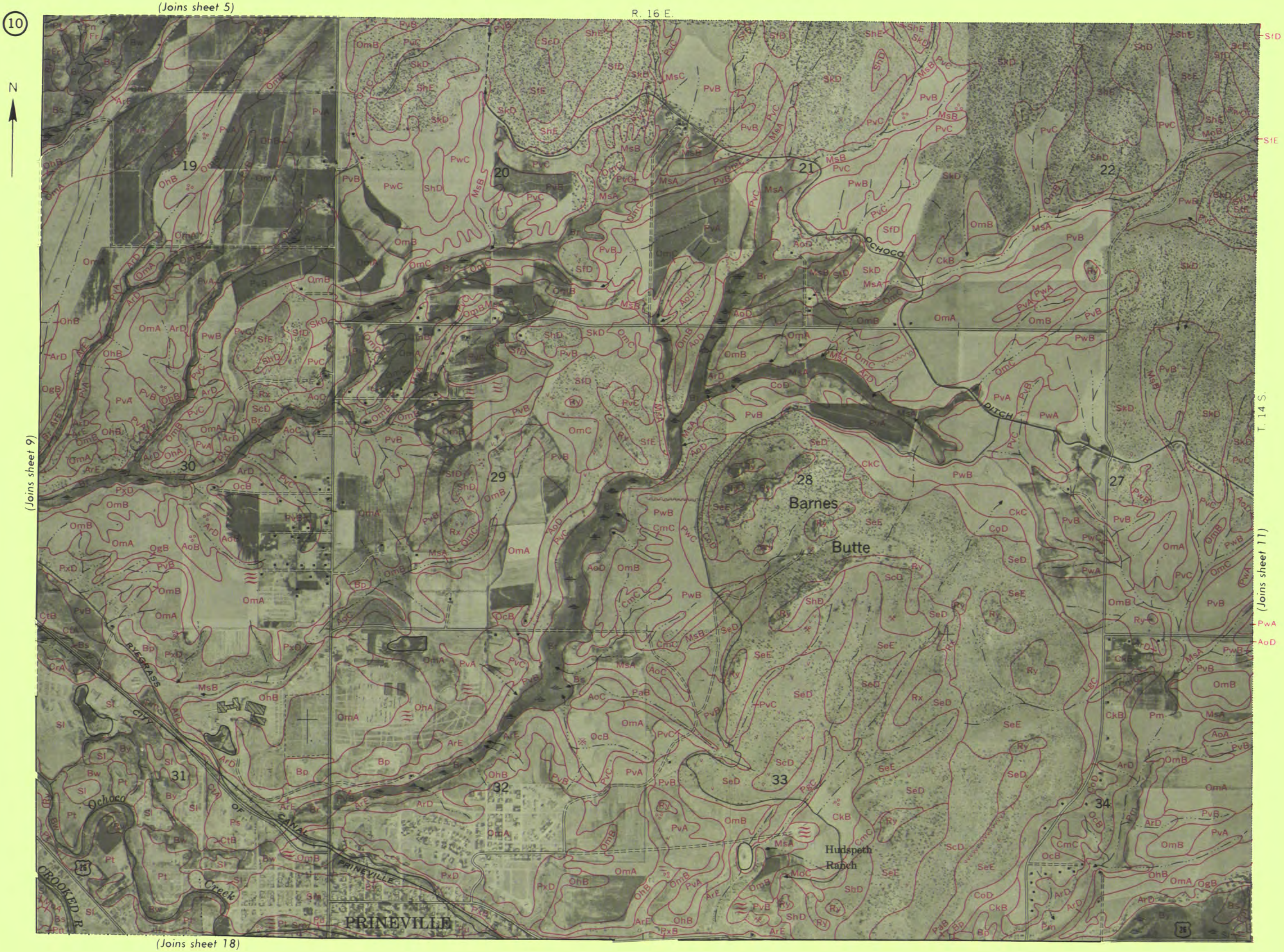
121°00′
120°50′
120°40′
120°30′
44°20′
44°10′




Original text from each individual map sheet read:
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oregon Agricultural Experiment Station. Range, township, and section corners shown on this map are indefinite.


(Joins sheet 3) | (Joins sheet 4)

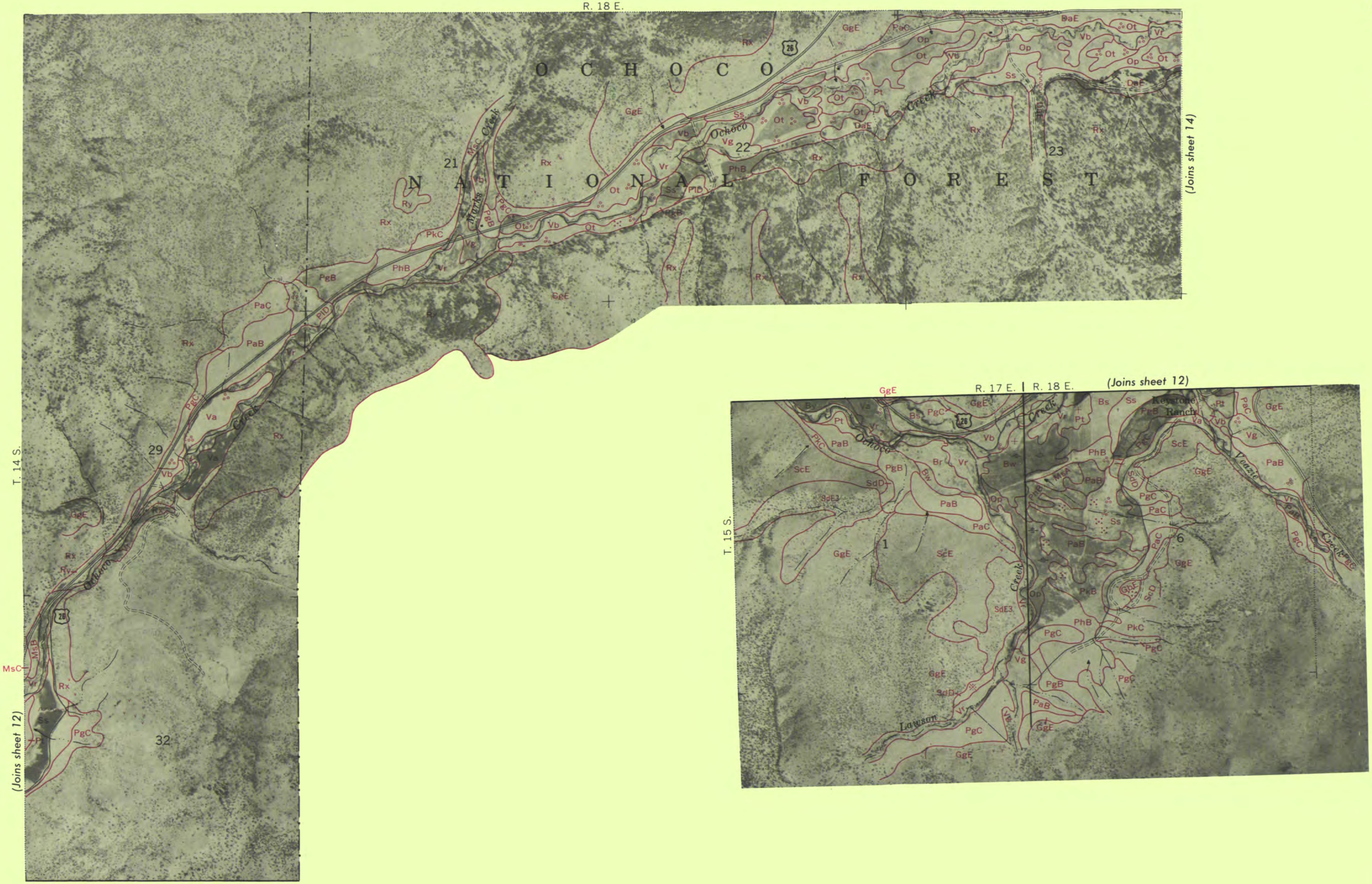
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet




0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

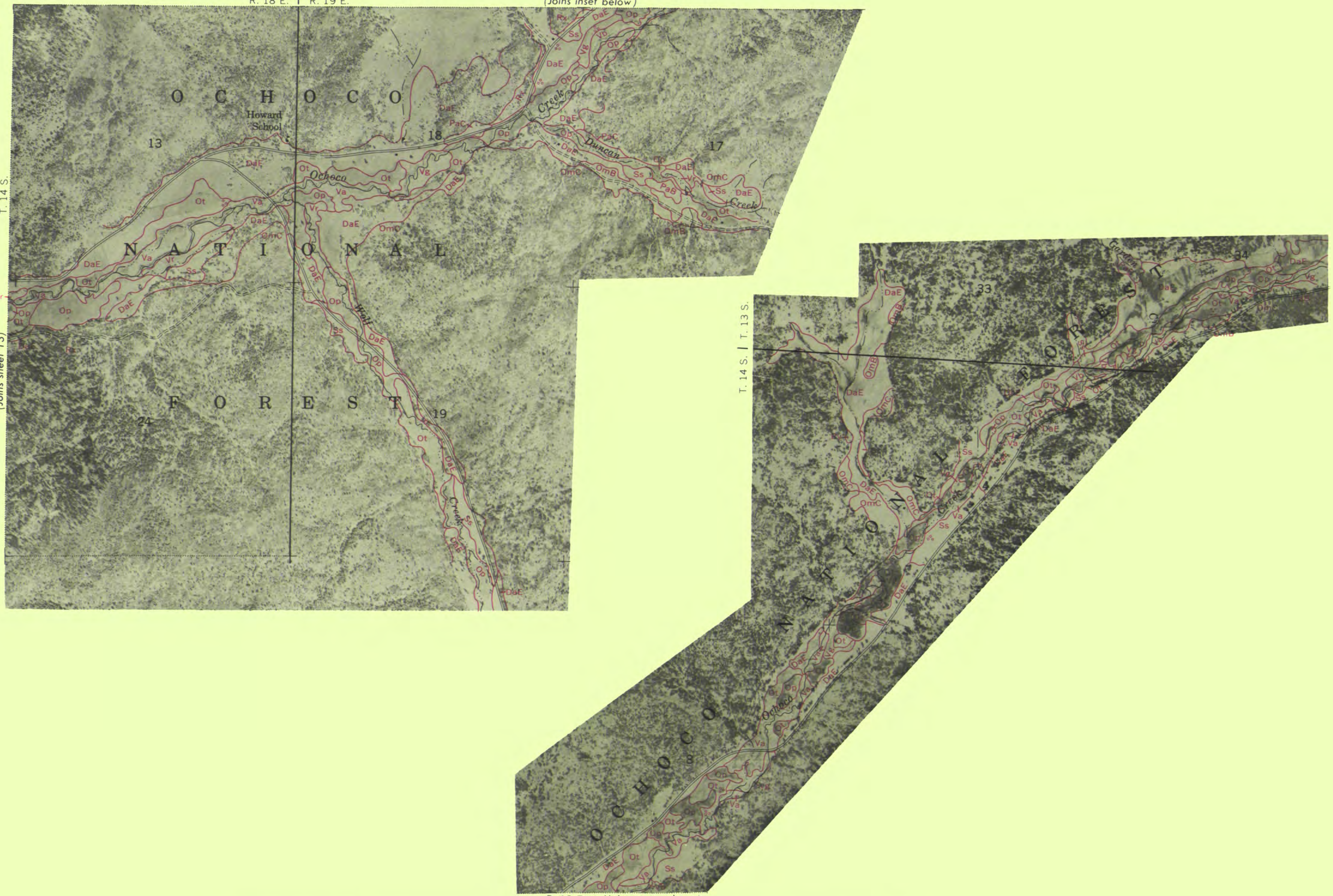

11
N
(Joins inset, sheet 5)
R. 16 E.
R. 17 E.
T. 14 S.
(Joins sheet 10)
(Joins sheet 19)
LIMIT OF DETAILED SOIL SURVEY
Johnson Creek Reservoir
Johnson Creek
OCHOCO DITCH
23
24
19
26
25
30
35
36
31
0
½
1 Mile
Scale 1:20 000
0
5000 Feet


12
(Joins sheet 6)
N
T. 14 S.
22
23
27
26
34
35
36
31
Mill Creek
Polly Creek
OCHOCO RESERVOIR
Ochoco Creek
LOOKOUT MTN GRANGE
26
(Joins sheet 13)
(Joins inset, sheet 13)
R. 17 E. | R. 18 E.
0
½
1 Mile
Scale 1:20 000
0
5000 Feet




0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

14



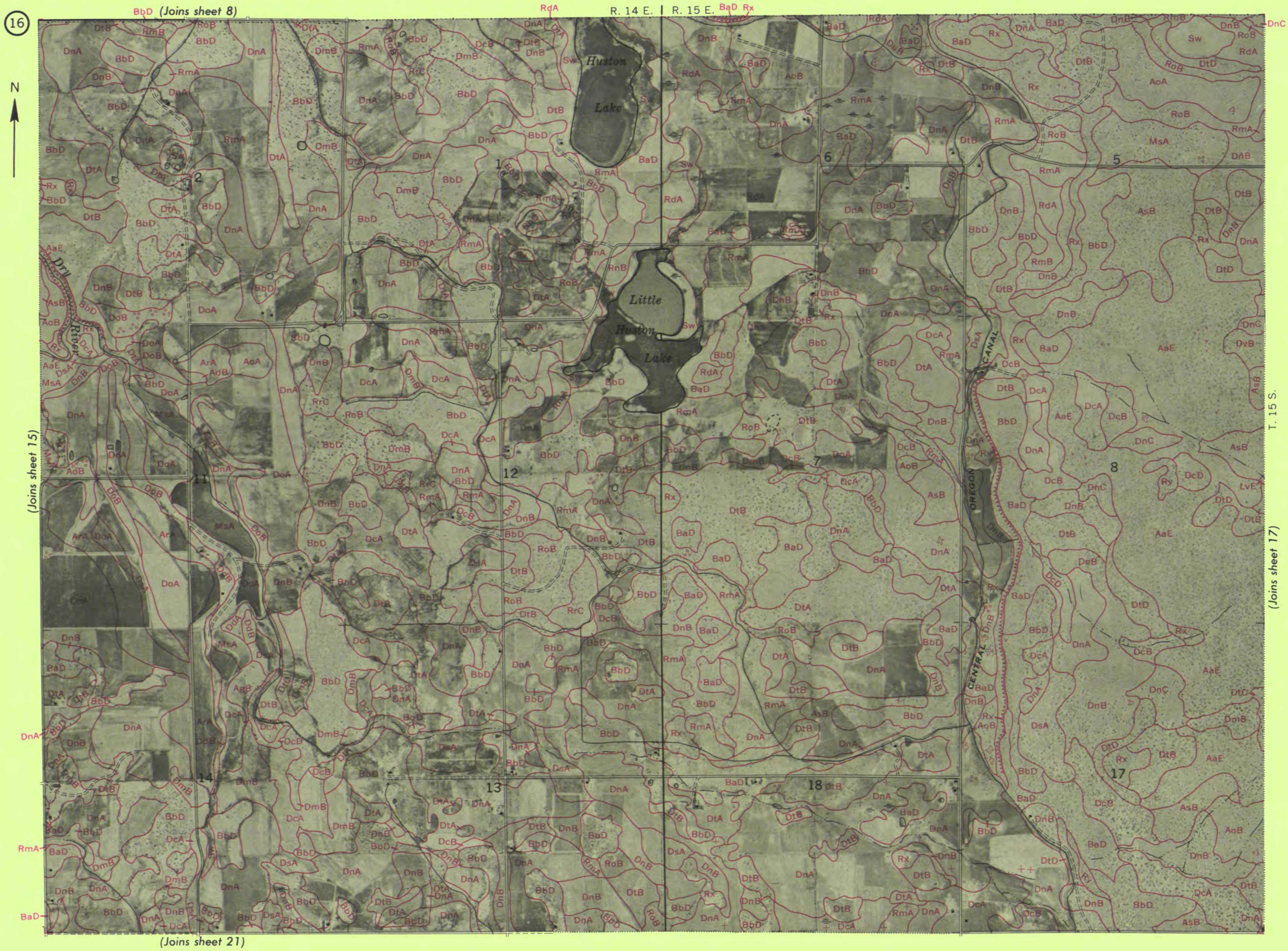

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

15

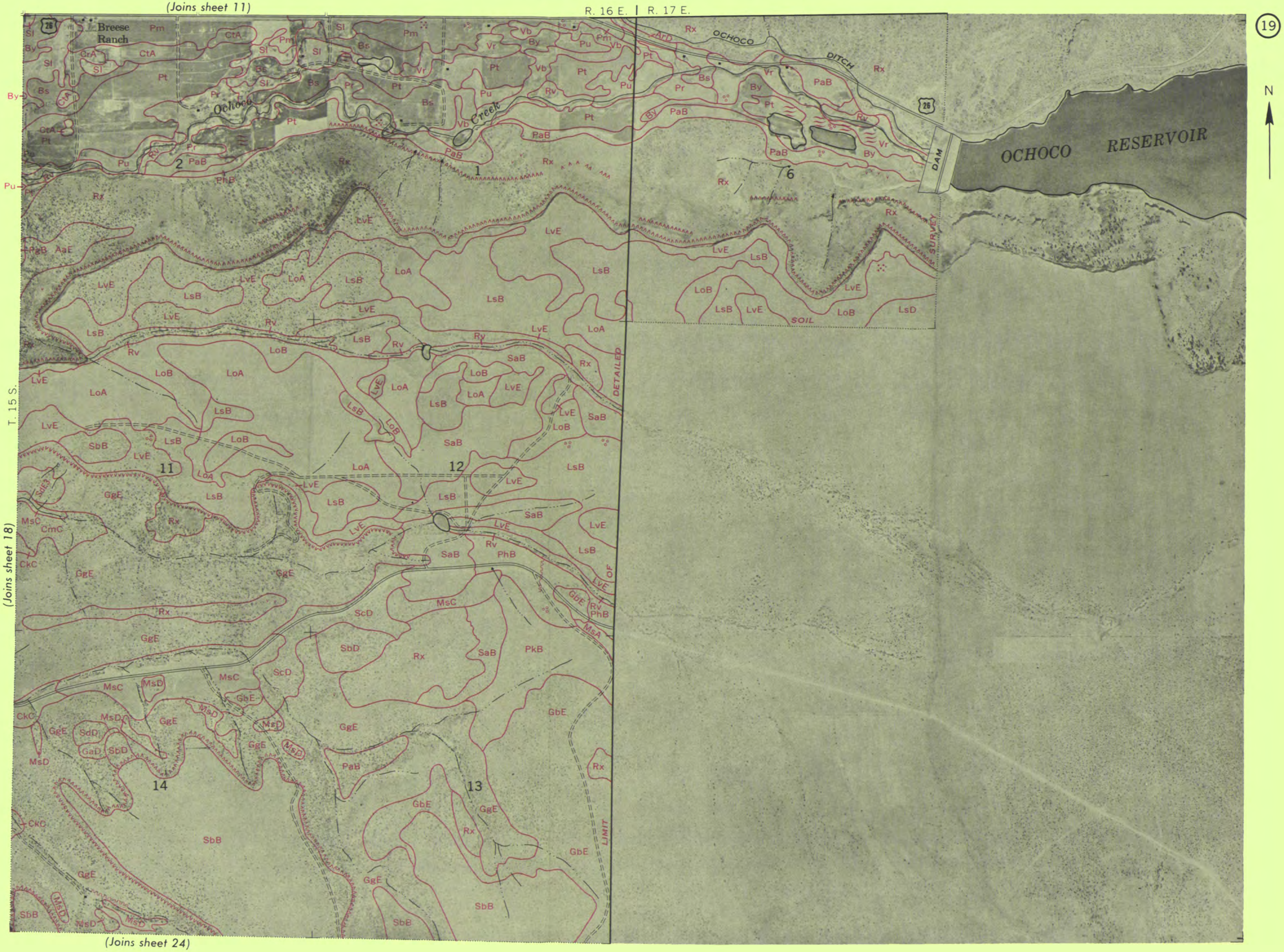

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



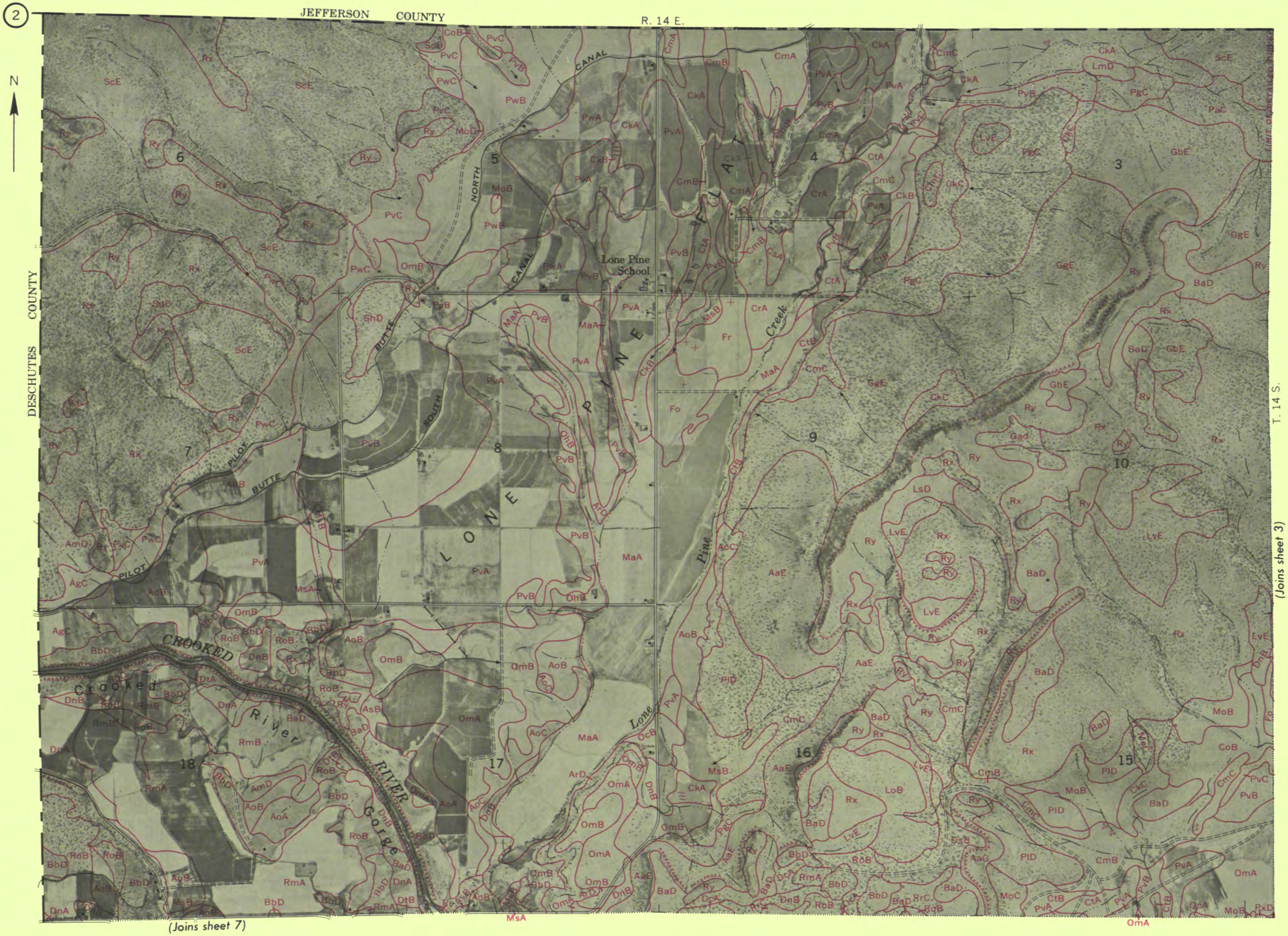

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

PRINEVILLE AREA, OREGON — SHEET NUMBER 17


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet




0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

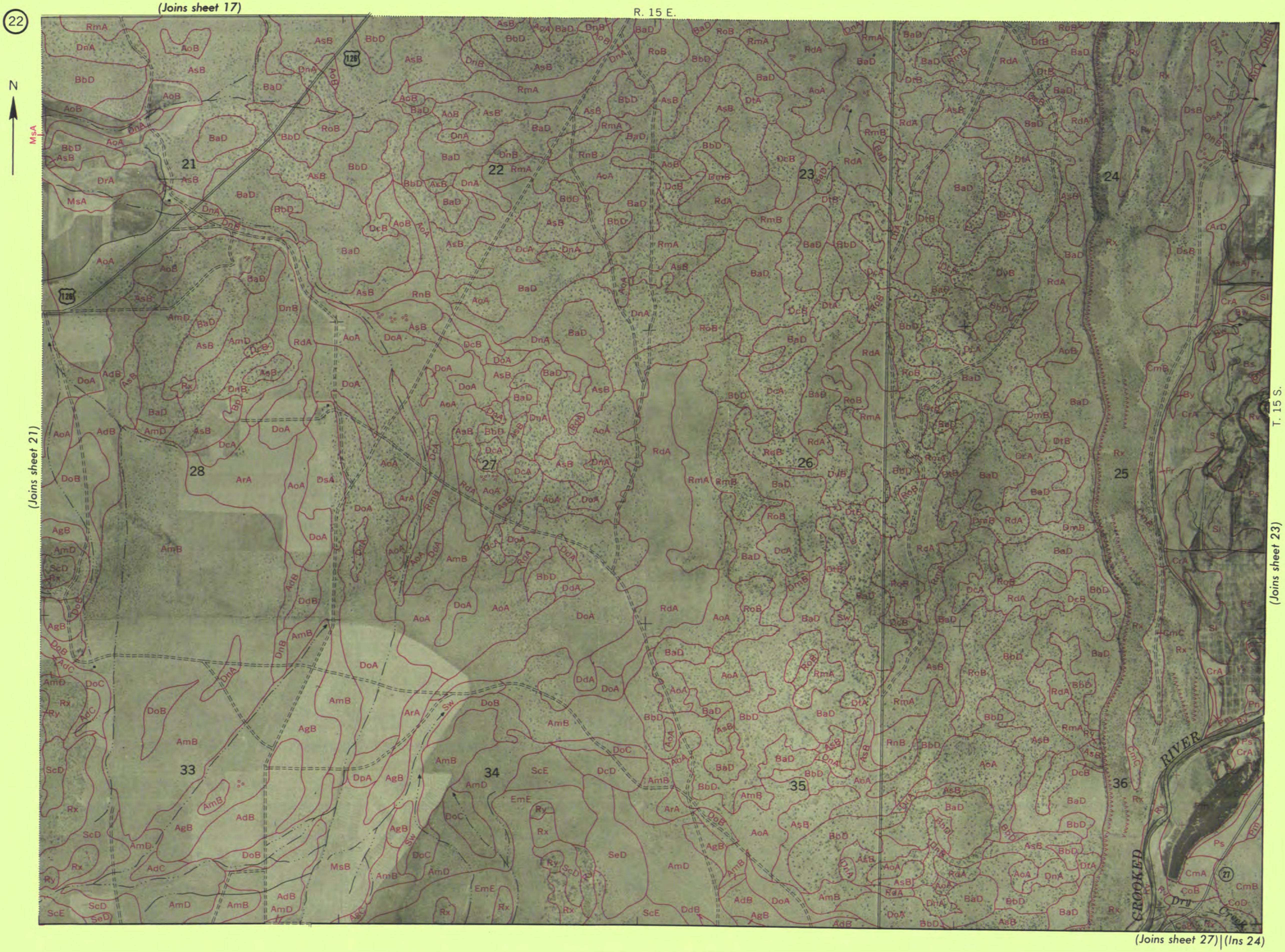



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

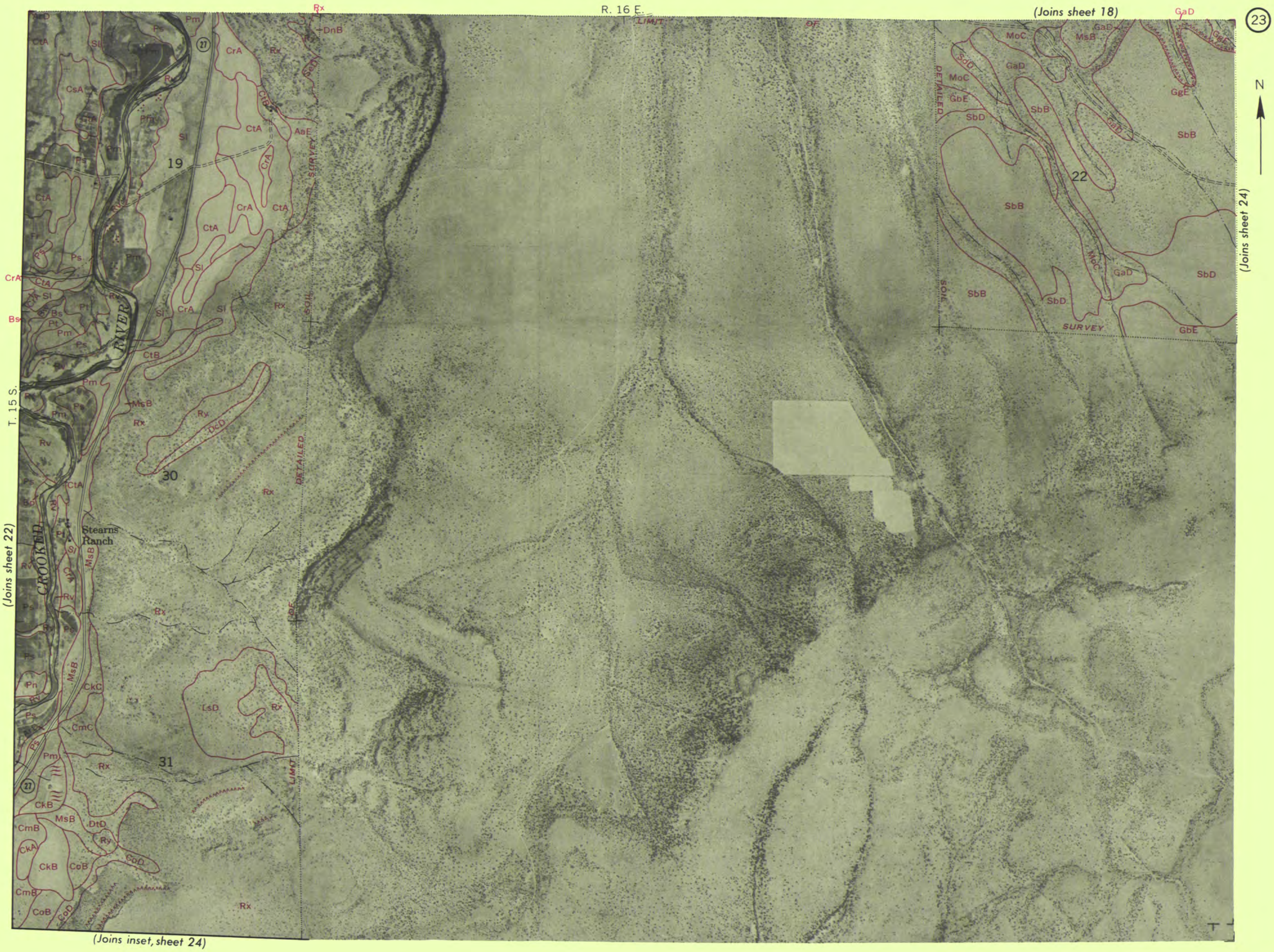

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

PRINEVILLE AREA, OREGON — SHEET NUMBER 21


0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

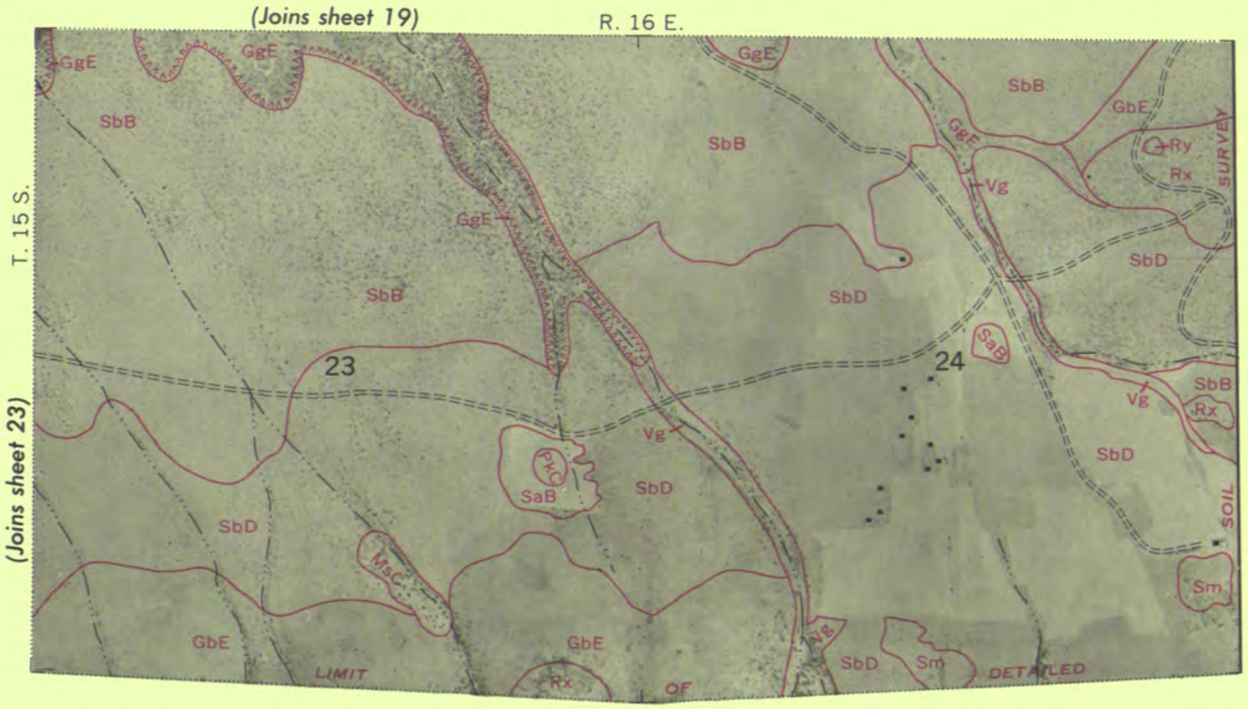


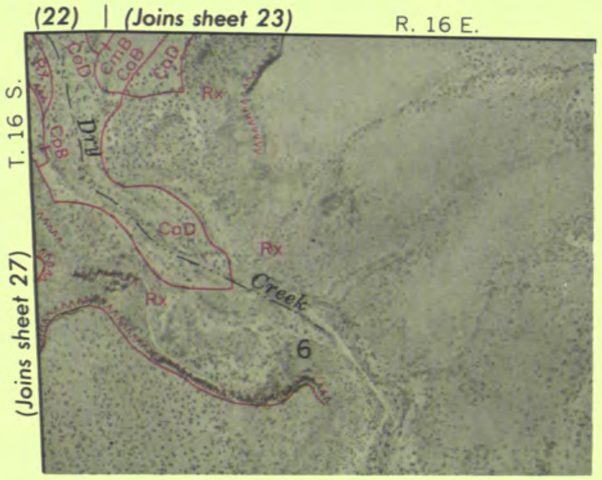

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


R. 16 E.
(Joins sheet 18)
23
N
(Joins sheet 24)
(Joins sheet 22)
(Joins inset, sheet 24)
T. 15 S.
CROOKED RIVER
Stearns Ranch
DETAILED SOIL SURVEY LIMIT
19
22
30
31
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

24

N

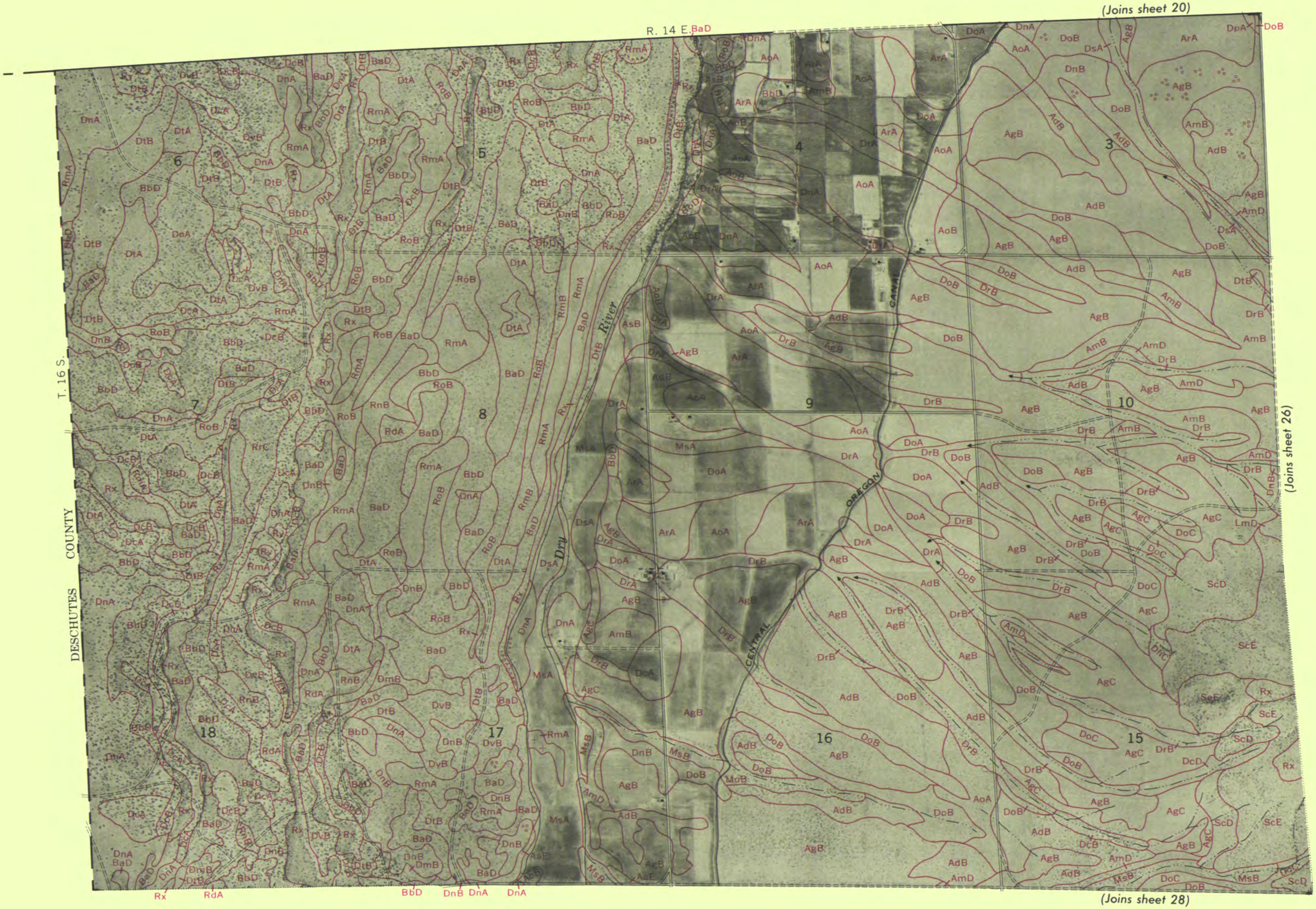




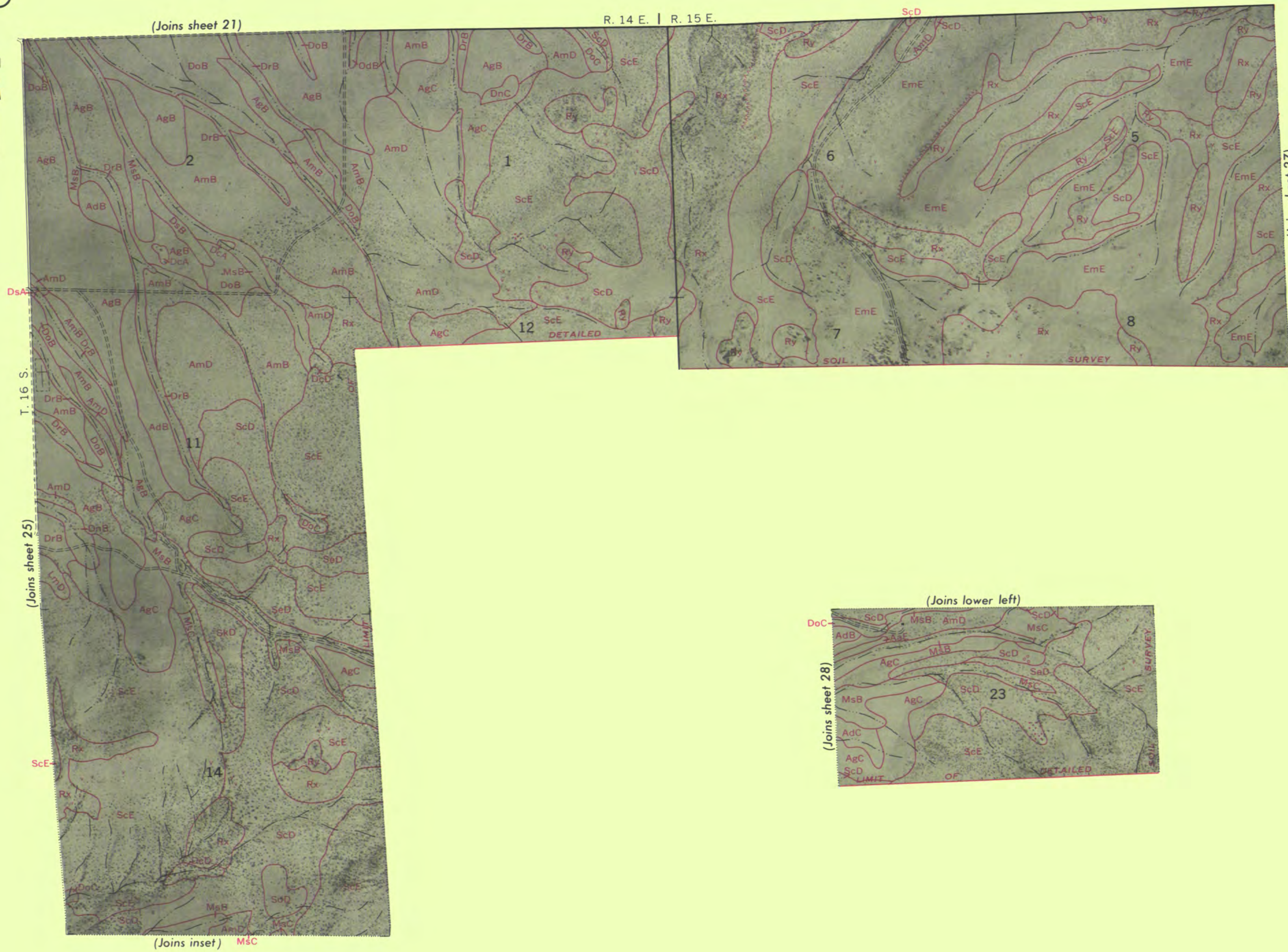
0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

25

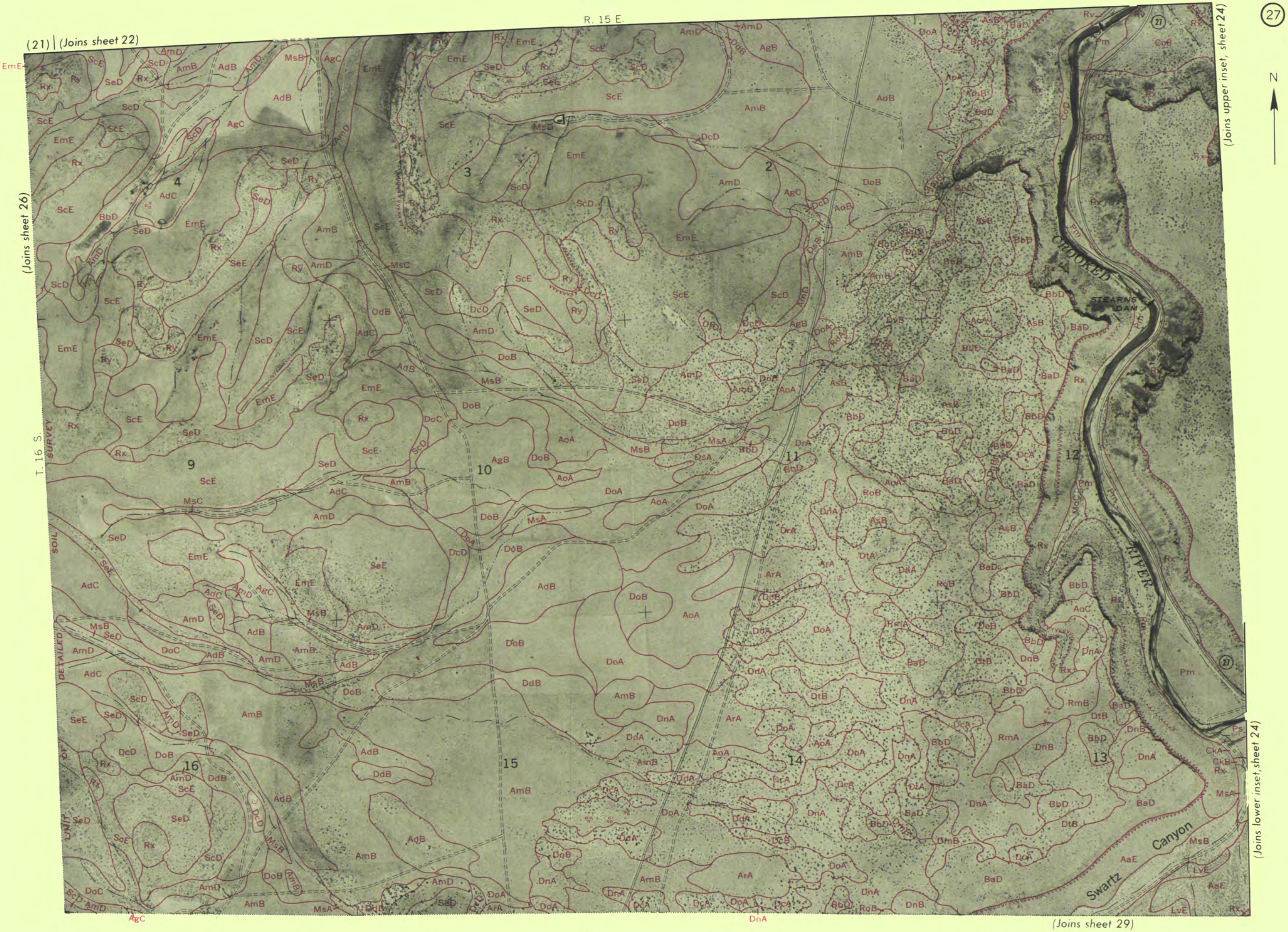



0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

26



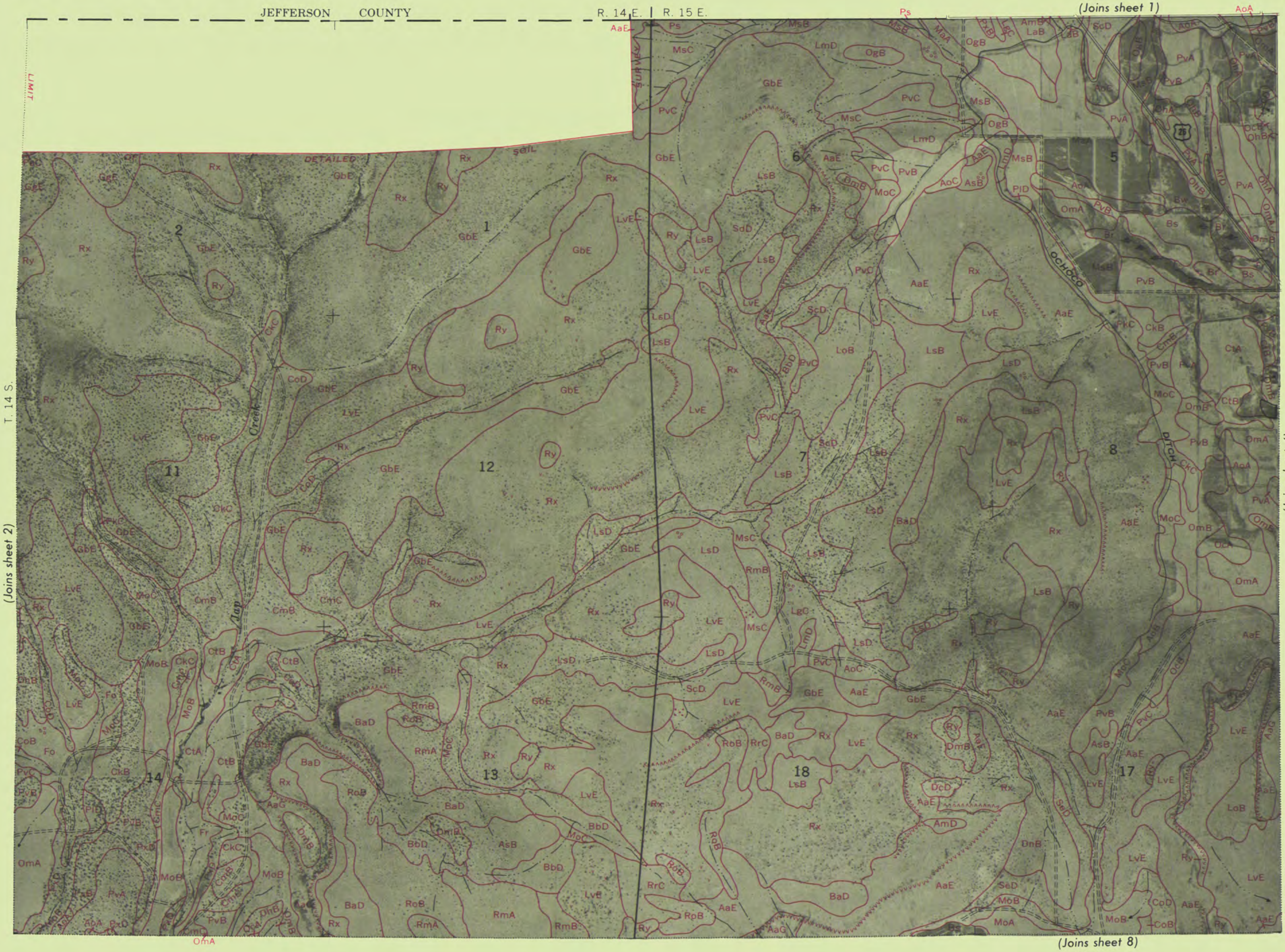

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet




0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


28
(Joins sheet 25)
R. 14 E.
(Joins inset, sheet 26)
N
DESCHUTES COUNTY
DESCHUTES COUNTY
T. 16 S.
Dry
River
CENTRAL OREGON CANAL
Shumway Lake
19
20
21
22
27
28
29
30
31
32
33
34
0 ½ 1 Mile
Scale 1: 20 000
0 5000 Feet

PRINEVILLE AREA, OREGON — SHEET NUMBER 29




0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


4
(Joins sheet 1)
R. 15 E.
N
(Joins sheet 3)
(Joins sheet 5)
T. 14 S.
(Joins sheet 9)
OCHOCO DITCH
DETAILED SOIL SURVEY LIMIT
GRIMES COMMUNITY HALL
Lytle Creek
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

5


(Joins sheet 11)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

6

N

R. 17 E.

(Joins inset)


(Joins sheet 12)


(Joins upper left)

R. 17 E.

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet


R. 14 E.
(Joins sheet 2)
7
N
Forest Crossing
Lone Pine
O'Neil
CROOKED
RIVER
CITY OF PRINEVILLE
Dry
River
T. 14 S.
DESCHUTES COUNTY
(Joins sheet 8)
(Joins sheet 15)
19
20
21
22
27
28
29
30
31
32
33
34
0
½
1 Mile
Scale 1:20 000
0
5000 Feet


0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

PRINEVILLE AREA, OREGON — SHEET NUMBER 9

## GUIDE TO MAPPING UNITS

[See table 1, page 23, for estimates of average yields of the principal crops; see table 2, page 26, and table 3, page 28, for engineering properties of the soils; see table 4, page 32, for approximate acreage and proportionate extent of the soils]

| Map symbol | Mapping unit | Page | Capability unit Symbol | Capability unit Page |
|---|---|---|---|---|
| AaE | Agency very stony sandy loam, 6 to 40 percent slopes | 34 | VIIs-1 | 21 |
| AaG | Agency very stony sandy loam, 40 to 70 percent slopes | 34 | VIIs-3 | 21 |
| AdB | Ayres sandy loam, 2 to 6 percent slopes | 35 | IIe-5 | 14 |
| AdC | Ayres sandy loam, 6 to 12 percent slopes | 35 | IIIe-3 | 16 |
| AgB | Ayres gravelly sandy loam, 2 to 6 percent slopes | 34 | IIe-5 | 14 |
| AgC | Ayres gravelly sandy loam, 6 to 12 percent slopes | 34 | IIIe-4 | 17 |
| AmB | Ayres stony sandy loam, 0 to 6 percent slopes | 35 | IVs-2 | 19 |
| AmD | Ayres stony sandy loam, 6 to 20 percent slopes | 35 | VIe-1 | 21 |
| AoA | Ayres and Ochoco sandy loams, 0 to 2 percent slopes | 35 | | |
| | Ayres sandy loam | -- | IIs-4 | 15 |
| | Ochoco sandy loam | -- | IIs-3 | 15 |
| AoB | Ayres and Ochoco sandy loams, 2 to 6 percent slopes | 35 | | |
| | Ayres sandy loam | -- | IIe-5 | 14 |
| | Ochoco sandy loam | -- | IIe-3 | 13 |
| AoC | Ayres and Ochoco sandy loams, 6 to 12 percent slopes | 36 | | |
| | Ayres sandy loam | -- | IIIe-3 | 16 |
| | Ochoco sandy loam | -- | IIIe-3 | 16 |
| AoD | Ayres and Ochoco sandy loams, 12 to 20 percent slopes | 36 | | |
| | Ayres sandy loam | -- | IVe-1 | 19 |
| | Ochoco sandy loam | -- | IVe-1 | 19 |
| ArA | Ayres and Ochoco gravelly sandy loams, 0 to 2 percent slopes | 36 | | |
| | Ayres gravelly sandy loam | -- | IIs-4 | 15 |
| | Ochoco gravelly sandy loam | -- | IIs-3 | 15 |
| ArD | Ayres and Ochoco gravelly sandy loams, 6 to 20 percent slopes | 36 | | |
| | Ayres gravelly sandy loam (6 to 12 percent slopes) | -- | IIIe-4 | 17 |
| | Ayres gravelly sandy loam (12 to 20 percent slopes) | -- | IVe-1 | 19 |
| | Ochoco gravelly sandy loam (6 to 12 percent slopes) | -- | IIIe-3 | 16 |
| | Ochoco gravelly sandy loam (12 to 20 percent slopes) | -- | IVe-1 | 19 |
| ArE | Ayres and Ochoco gravelly sandy loams, 20 to 40 percent slopes | 36 | | |
| | Ayres gravelly sandy loam | -- | VIe-1 | 21 |
| | Ochoco gravelly sandy loam | -- | VIe-1 | 21 |
| AsB | Ayres and Ochoco stony sandy loams, 0 to 6 percent slopes | 36 | | |
| | Ayres stony sandy loam | -- | IVs-2 | 19 |
| | Ochoco stony sandy loam | -- | IVs-2 | 19 |
| BaD | Bakeoven very stony sandy loam, 0 to 20 percent slopes | 36 | VIIs-2 | 21 |
| BbD | Bakeoven very stony sandy loam, 0 to 20 percent slopes | 37 | VIIs-2 | 21 |
| Bp | Borrow pits | 37 | VIIIs-1 | 22 |
| Br | Boyce loam, light-colored variant | 38 | IIIw-1 | 18 |
| Bs | Boyce silt loam | 37 | IIIw-1 | 18 |
| Bw | Boyce silt loam, ponded | 37 | Vw-1 | 20 |
| By | Boyce silty clay loam | 37 | IIIw-1 | 18 |
| CkA | Courtrock sandy loam, 0 to 2 percent slopes | 39 | IIs-5 | 15 |
| CkB | Courtrock sandy loam, 2 to 6 percent slopes | 39 | IIe-2 | 13 |
| CkC | Courtrock sandy loam, 6 to 12 percent slopes | 39 | IIIe-2 | 16 |
| CmA | Courtrock gravelly sandy loam, 0 to 2 percent slopes | 39 | IIs-2 | 14 |
| CmB | Courtrock gravelly sandy loam, 2 to 6 percent slopes | 39 | IIe-2 | 13 |
| CmC | Courtrock gravelly sandy loam, 6 to 12 percent slopes | 39 | IIIe-2 | 16 |
| CoB | Courtrock stony sandy loam, 2 to 6 percent slopes | 39 | IVs-2 | 19 |
| CoD | Courtrock stony sandy loam, 6 to 20 percent slopes | 40 | VIe-1 | 21 |
| CrA | Crooked loam, 0 to 2 percent slopes | 41 | IIIw-2 | 18 |
| CsA | Crooked loamy sand, 0 to 2 percent slopes | 40 | IIIw-2 | 18 |
| CtA | Crooked sandy loam, 0 to 2 percent slopes | 40 | IIIw-2 | 18 |
| CtB | Crooked sandy loam, 2 to 6 percent slopes | 40 | IIIw-2 | 18 |
| DaE | Day clay, 6 to 40 percent slopes | 41 | VIIs-1 | 21 |
| DcA | Deschutes loamy sand, 0 to 2 percent slopes | 43 | IIIs-1 | 18 |
| DcB | Deschutes loamy sand, 2 to 6 percent slopes | 43 | IIIs-1 | 18 |
| DcD | Deschutes loamy sand, 6 to 20 percent slopes | 43 | IVs-1 | 19 |
| DdA | Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes | 43 | IIIs-1 | 18 |
| DdB | Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes | 44 | IIIs-1 | 18 |
| DmB | Deschutes stony loamy sand, 0 to 6 percent slopes | 44 | IVs-2 | 19 |
| DnA | Deschutes sandy loam, 0 to 2 percent slopes | 41 | IIs-1 | 14 |
| DnB | Deschutes sandy loam, 2 to 6 percent slopes | 41 | IIe-1 | 12 |
| DnC | Deschutes sandy loam, 6 to 12 percent slopes | 42 | IIIe-1 | 16 |
| DoA | Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes | 42 | IIs-3 | 15 |
| DoB | Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes | 42 | IIe-3 | 13 |
| DoC | Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes | 42 | IIIe-3 | 16 |
| DpA | Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes | 42 | IIs-3 | 15 |
| DrA | Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes | 42 | IIs-1 | 14 |
| DrB | Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes | 43 | IIe-1 | 12 |
| DsA | Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes | 42 | IIs-1 | 14 |
| DsB | Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes | 42 | IIe-1 | 12 |
| DtA | Deschutes stony sandy loam, 0 to 2 percent slopes | 43 | IVs-2 | 19 |
| DtB | Deschutes stony sandy loam, 2 to 6 percent slopes | 43 | IVs-2 | 19 |
| DtD | Deschutes stony sandy loam, 6 to 20 percent slopes | 43 | VIe-1 | 21 |
| DuB | Deschutes-Bakeoven very stony sandy loams, 0 to 6 percent slopes | 44 | | |
| | Deschutes very stony sandy loam | -- | VIIs-2 | 21 |
| | Bakeoven very stony sandy loam | -- | VIIs-2 | 21 |
| DvB | Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes | 44 | | |
| | Deschutes sandy loam (0 to 2 percent slopes) | -- | IIs-1 | 14 |
| | Deschutes sandy loam (2 to 6 percent slopes) | -- | IIe-1 | 12 |
| | Bakeoven very stony sandy loam | -- | VIIs-2 | 21 |
| EmE | Elmore very stony loam, 6 to 40 percent slopes | 44 | VIIs-4 | 21 |
| Fo | Forester loamy sand | 45 | IIIw-2 | 18 |
| Fr | Forester sandy loam | 45 | IIIw-2 | 18 |
| GaD | Gem stony loam, 6 to 20 percent slopes | 45 | VIe-2 | 21 |
| GbE | Gem very stony loam, 6 to 40 percent slopes | 45 | VIIs-4 | 21 |
| GcE | Gem-Day stony clay loams, 12 to 40 percent slopes | 45 | | |
| | Gem stony clay loam | -- | VIe-2 | 21 |
| | Day clay | -- | VIIs-1 | 21 |
| GgE | Gem-Searles stony loams, 6 to 40 percent slopes | 45 | | |
| | Gem stony loam | -- | VIe-2 | 21 |
| | Searles stony loam | -- | VIe-1 | 21 |
| LaB | Lamonta loam, 0 to 6 percent slopes | 46 | IIe-4 | 13 |
| LgC | Lamonta gravelly loam, 6 to 12 percent slopes | 46 | IIIe-4 | 17 |
| LmD | Lamonta stony loam, 6 to 20 percent slopes | 46 | VIe-1 | 21 |
| LoA | Lookout loam, 0 to 2 percent slopes | 47 | IIe-4 | 13 |
| LoB | Lookout loam, 2 to 6 percent slopes | 47 | IIe-4 | 13 |
| LsB | Lookout stony loam, 0 to 6 percent slopes | 47 | VIe-1 | 21 |
| LsD | Lookout stony loam, 6 to 20 percent slopes | 47 | VIe-1 | 21 |
| LvE | Lookout very stony loam, 0 to 40 percent slopes | 46 | VIIs-1 | 21 |
| MaA | Metolius loam, 0 to 2 percent slopes | 48 | IIs-5 | 15 |
| MoA | Metolius loamy sand, 0 to 2 percent slopes | 48 | IIIs-1 | 18 |
| MoB | Metolius loamy sand, 2 to 6 percent slopes | 48 | IIIs-1 | 18 |

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GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit Symbol | Capability unit Page |
|---|---|---|---|---|
| MoC | Metolius loamy sand, 6 to 12 percent slopes | 48 | IVs-1 | 19 |
| MsA | Metolius sandy loam, 0 to 2 percent slopes | 47 | IIs-5 | 15 |
| MsB | Metolius sandy loam, 2 to 6 percent slopes | 47 | IIe-2 | 13 |
| MsC | Metolius sandy loam, 6 to 12 percent slopes | 48 | IIIe-2 | 16 |
| MsD | Metolius sandy loam, 12 to 20 percent slopes | 48 | IVe-1 | 19 |
| OcA | Ochoco loam, 0 to 2 percent slopes | 50 | IIs-3 | 15 |
| OcB | Ochoco loam, 2 to 6 percent slopes | 51 | IIe-3 | 13 |
| OdB | Ochoco loamy sand, 2 to 6 percent slopes | 50 | IIIs-1 | 18 |
| OgB | Ochoco gravelly loam, 2 to 6 percent slopes | 51 | IIe-3 | 13 |
| OhA | Ochoco gravelly sandy loam, 0 to 2 percent slopes | 49 | IIs-3 | 15 |
| OhB | Ochoco gravelly sandy loam, 2 to 6 percent slopes | 49 | IIe-3 | 13 |
| OmA | Ochoco sandy loam, 0 to 2 percent slopes | 49 | IIs-3 | 15 |
| OmB | Ochoco sandy loam, 2 to 6 percent slopes | 49 | IIe-3 | 13 |
| OmC | Ochoco sandy loam, 6 to 12 percent slopes | 49 | IIIe-3 | 16 |
| OoA | Ochoco sandy loam, seeped, 0 to 2 percent slopes | 49 | IIIw-1 | 18 |
| Op | Ontko clay loam, ponded | 51 | Vw-1 | 20 |
| Ot | Ontko clay loam and clay | 51 | IVw-2 | 19 |
| PaB | Polly loam, 0 to 6 percent slopes | 52 | IIe-4 | 13 |
| PaC | Polly loam, 6 to 12 percent slopes | 52 | IIIe-3 | 16 |
| PgB | Polly gravelly loam, 0 to 6 percent slopes | 52 | IIe-4 | 13 |
| PgC | Polly gravelly loam, 6 to 12 percent slopes | 52 | IIIe-3 | 16 |
| PhB | Polly sandy loam, 2 to 6 percent slopes | 52 | IIe-4 | 13 |
| PkB | Polly sandy loam, thick surface, 2 to 6 percent slopes | 53 | IIe-4 | 13 |
| PkC | Polly sandy loam, thick surface, 6 to 12 percent slopes | 53 | IIIe-3 | 16 |
| PlD | Polly stony loam, 6 to 20 percent slopes | 52 | VIe-2 | 21 |
| Pm | Powder loam | 53 | IIc-1 | 15 |
| Pn | Powder fine sandy loam, coarse variant | 54 | IIe-6 | 14 |
| Po | Powder fine sandy loam, over gravel, coarse variant | 55 | IIe-6 | 14 |
| Pr | Powder gravelly loam | 53 | IIe-6 | 14 |
| Ps | Powder sandy loam | 54 | IIc-1 | 15 |
| Pt | Powder silt loam | 53 | IIe-6 | 14 |
| Pu | Powder silt loam, over gravel | 53 | IIe-6 | 14 |
| PvA | Prineville sandy loam, 0 to 2 percent slopes | 55 | IIs-1 | 14 |
| PvB | Prineville sandy loam, 2 to 6 percent slopes | 55 | IIe-1 | 12 |
| PvC | Prineville sandy loam, 6 to 12 percent slopes | 55 | IIIe-1 | 16 |
| PwA | Prineville sandy loam, thick surface, 0 to 2 percent slopes | 55 | IIs-2 | 14 |
| PwB | Prineville sandy loam, thick surface, 2 to 6 percent slopes | 56 | IIe-2 | 13 |
| PwC | Prineville sandy loam, thick surface, 6 to 12 percent slopes | 56 | IIIe-2 | 16 |
| PxB | Prineville gravelly sandy loam, 2 to 6 percent slopes | 56 | IIe-1 | 12 |
| PxD | Prineville gravelly sandy loam, 6 to 20 percent slopes | 56 | IVe-1 | 19 |
| RdA | Redmond loam, 0 to 2 percent slopes | 57 | IIs-3 | 15 |
| RmA | Redmond sandy loam, 0 to 2 percdnt slopes | 56 | IIs-3 | 15 |
| RmB | Redmond sandy loam, 2 to 6 percent slopes | 57 | IIe-3 | 13 |
| RnB | Redmond stony loam, 0 to 6 percent slopes | 57 | IVs-2 | 19 |
| RoB | Redmond stony sandy loam, 0 to 6 percent slopes | 57 | IVs-2 | 19 |
| RrC | Redmond very stony sandy loam, 6 to 12 percent slopes | 57 | VIIs-1 | 21 |
| Rv | Riverwash | 57 | VIIIs-1 | 22 |
| Rx | Rock land | 57 | VIIs-1 | 21 |
| Ry | Rock outcrop | 58 | VIIIs-1 | 22 |
| SaB | Salisbury loam, 0 to 6 percent slopes | 59 | IIe-4 | 13 |
| SbB | Salisbury very stony loam, 0 to 6 percent slopes | 59 | VIIs-4 | 21 |
| SbD | Salisbury very stony loam, 6 to 20 percent slopes | 59 | VIIs-4 | 21 |
| ScD | Searles stony loam, 2 to 20 percent slopes | 59 | VIe-1 | 21 |
| ScE | Searles stony loam, 20 to 40 percent slopes | 59 | VIe-1 | 21 |
| SdD | Searles stony clay loam, 6 to 20 percent slopes | 59 | VIe-1 | 21 |
| SdE3 | Searles stony clay loam, 20 to 40 percent slopes, severely eroded | 59 | VIIs-3 | 21 |
| SeD | Searles stony sandy loam, 6 to 20 percent slopes | 59 | VIe-1 | 21 |
| SeE | Searles stony sandy loam, 20 to 40 percent slopes | 60 | VIe-1 | 21 |
| SfD | Searles-Slayton complex, 2 to 20 percent slopes | 60 | | |
| | Searles stony sandy loam | -- | VIe-1 | 21 |
| | Slayton sandy loam | -- | IVe-1 | 19 |
| SfE | Searles-Slayton complex, 20 to 40 percent slopes | 60 | | |
| | Searles stony sandy loam | -- | VIe-1 | 21 |
| | Slayton channery sandy loam | -- | VIe-1 | 21 |
| ShD | Slayton channery sandy loam, 2 to 20 percent slopes | 60 | VIe-1 | 21 |
| ShE | Slayton channery sandy loam, 20 to 40 percent slopes | 60 | VIe-1 | 21 |
| SkD | Slayton sandy loam, 2 to 20 percent slopes | 60 | IVe-1 | 19 |
| Sl | Stearns silt loam | 61 | IVw-3 | 19 |
| Sm | Stearns-Crooked complex | 61 | | |
| | Stearns silt loam | -- | IVw-3 | 19 |
| | Crooked loam | -- | IIIw-2 | 18 |
| Ss | Steiger sandy loam | 61 | IIIs-2 | 18 |
| Sw | Swartz silt loam | 61 | IVw-1 | 19 |
| Va | Veazie loam | 62 | IIIs-2 | 18 |
| Vb | Veazie loam, shallow | 62 | IIIs-2 | 18 |
| Vg | Veazie gravelly loam | 62 | IIIs-2 | 18 |
| Vr | Veazie-Riverwash complex | 62 | | |
| | Veazie loam | -- | IIIs-2 | 18 |
| | Riverwash | -- | VIIIs-1 | 22 |

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# PRINEVILLE AREA, OREGON

## CONVENTIONAL SIGNS

### WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail, foot
- Railroad
- Ferry
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings

- School
- Church

Mine and Quarry

Pit, gravel or other

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Oil wells

### BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

### DRAINAGE

Streams

- Perennial
- Intermittent

Canal or ditch — CANAL / DITCH

Lakes and ponds

- Perennial
- Intermittent

Wells — flowing

Springs

Marsh or swamp

Wet spot

Alluvial fan

### RELIEF

Escarpments

- Bedrock
- Other

Prominent peak

Depressions — Large / Small

- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

### SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline spot

## SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are those of nearly level soils, such as Boyce silt loam, but some others, such as Rock land, have a considerable range of slope. A final number, 3, in a symbol, shows that the soil is named as severely eroded.

| SYMBOL | NAME |
|---|---|
| AaE | Agency very stony sandy loam, 6 to 40 percent slopes |
| AaG | Agency very stony sandy loam, 40 to 70 percent slopes |
| AdB | Ayres sandy loam, 2 to 6 percent slopes |
| AdC | Ayres sandy loam, 6 to 12 percent slopes |
| AgB | Ayres gravelly sandy loam, 2 to 6 percent slopes |
| AgC | Ayres gravelly sandy loam, 6 to 12 percent slopes |
| AmB | Ayres stony sandy loam, 0 to 6 percent slopes |
| AmD | Ayres stony sandy loam, 6 to 20 percent slopes |
| AoA | Ayres and Ochoco sandy loams, 0 to 2 percent slopes |
| AoB | Ayres and Ochoco sandy loams, 2 to 6 percent slopes |
| AoC | Ayres and Ochoco sandy loams, 6 to 12 percent slopes |
| AoD | Ayres and Ochoco sandy loams, 12 to 20 percent slopes |
| ArA | Ayres and Ochoco gravelly sandy loams, 0 to 2 percent slopes |
| ArD | Ayres and Ochoco gravelly sandy loams, 6 to 20 percent slopes |
| ArE | Ayres and Ochoco gravelly sandy loams, 20 to 40 percent slopes |
| AsB | Ayres and Ochoco stony sandy loams, 0 to 6 percent slopes |
| BaD | Bakeoven very stony loam, 0 to 20 percent slopes |
| BbD | Bakeoven very stony sandy loam, 0 to 20 percent slopes |
| Bp | Borrow pits |
| Br | Boyce loam, light-colored variant |
| Bs | Boyce silt loam |
| Bw | Boyce silt loam, ponded |
| By | Boyce silty clay loam |
| CkA | Courtrock sandy loam, 0 to 2 percent slopes |
| CkB | Courtrock sandy loam, 2 to 6 percent slopes |
| CkC | Courtrock sandy loam, 6 to 12 percent slopes |
| CmA | Courtrock gravelly sandy loam, 0 to 2 percent slopes |
| CmB | Courtrock gravelly sandy loam, 2 to 6 percent slopes |
| CmC | Courtrock gravelly sandy loam, 6 to 12 percent slopes |
| CoB | Courtrock stony sandy loam, 2 to 6 percent slopes |
| CoD | Courtrock stony sandy loam, 6 to 20 percent slopes |
| CrA | Crooked loam, 0 to 2 percent slopes |
| CsA | Crooked loamy sand, 0 to 2 percent slopes |
| CtA | Crooked sandy loam, 0 to 2 percent slopes |
| CtB | Crooked sandy loam, 2 to 6 percent slopes |
| DaE | Day clay, 6 to 40 percent slopes |
| DcA | Deschutes loamy sand, 0 to 2 percent slopes |
| DcB | Deschutes loamy sand, 2 to 6 percent slopes |
| DcD | Deschutes loamy sand, 6 to 20 percent slopes |
| DdA | Deschutes loamy sand, moderately deep over hardpan, 0 to 2 percent slopes |
| DdB | Deschutes loamy sand, moderately deep over hardpan, 2 to 6 percent slopes |
| DmB | Deschutes stony loamy sand, 0 to 6 percent slopes |
| DnA | Deschutes sandy loam, 0 to 2 percent slopes |
| DnB | Deschutes sandy loam, 2 to 6 percent slopes |
| DnC | Deschutes sandy loam, 6 to 12 percent slopes |
| DoA | Deschutes sandy loam, moderately deep over hardpan, 0 to 2 percent slopes |
| DoB | Deschutes sandy loam, moderately deep over hardpan, 2 to 6 percent slopes |
| DoC | Deschutes sandy loam, moderately deep over hardpan, 6 to 12 percent slopes |
| DpA | Deschutes sandy loam, deep over hardpan, 0 to 2 percent slopes |
| DrA | Deschutes sandy loam, moderately deep over gravel, 0 to 2 percent slopes |
| DrB | Deschutes sandy loam, moderately deep over gravel, 2 to 6 percent slopes |
| DsA | Deschutes sandy loam, deep over basalt, 0 to 2 percent slopes |
| DsB | Deschutes sandy loam, deep over basalt, 2 to 6 percent slopes |
| DtA | Deschutes stony sandy loam, 0 to 2 percent slopes |
| DtB | Deschutes stony sandy loam, 2 to 6 percent slopes |
| DtD | Deschutes stony sandy loam, 6 to 20 percent slopes |
| DuB | Deschutes-Bakeoven very stony sandy loams, 0 to 6 percent slopes |
| DvB | Deschutes-Bakeoven sandy loams, 0 to 6 percent slopes |
| EmE | Elmore very stony loam, 6 to 40 percent slopes |
| Fo | Forester loamy sand |
| Fr | Forester sandy loam |
| GaD | Gem stony loam, 6 to 20 percent slopes |
| GbE | Gem very stony loam, 6 to 40 percent slopes |
| GcE | Gem-Day stony clay loams, 12 to 40 percent slopes |
| GgE | Gem-Searles stony loams, 6 to 40 percent slopes |
| LaB | Lamonta loam, 0 to 6 percent slopes |
| LgC | Lamonta gravelly loam, 6 to 12 percent slopes |
| LmD | Lamonta stony loam, 6 to 20 percent slopes |
| LoA | Lookout loam, 0 to 2 percent slopes |
| LoB | Lookout loam, 2 to 6 percent slopes |
| LsB | Lookout stony loam, 0 to 6 percent slopes |
| LsD | Lookout stony loam, 6 to 20 percent slopes |
| LvE | Lookout very stony loam, 0 to 40 percent slopes |
| MaA | Metolius loam, 0 to 2 percent slopes |
| McA | Metolius loamy sand, 0 to 2 percent slopes |
| McB | Metolius loamy sand, 2 to 6 percent slopes |
| McC | Metolius loamy sand, 6 to 12 percent slopes |
| MsA | Metolius sandy loam, 0 to 2 percent slopes |
| MsB | Metolius sandy loam, 2 to 6 percent slopes |
| MsC | Metolius sandy loam, 6 to 12 percent slopes |
| MsD | Metolius sandy loam, 12 to 20 percent slopes |
| OcA | Ochoco loam, 0 to 2 percent slopes |
| OcB | Ochoco loam, 2 to 6 percent slopes |
| OdB | Ochoco loamy sand, 2 to 6 percent slopes |
| OgB | Ochoco gravelly loam, 2 to 6 percent slopes |
| OhA | Ochoco gravelly sandy loam, 0 to 2 percent slopes |
| OhB | Ochoco gravelly sandy loam, 2 to 6 percent slopes |
| OmA | Ochoco sandy loam, 0 to 2 percent slopes |
| OmB | Ochoco sandy loam, 2 to 6 percent slopes |
| OmC | Ochoco sandy loam, 6 to 12 percent slopes |
| OoA | Ochoco sandy loam, seeped, 0 to 2 percent slopes |
| Op | Ontko clay loam, ponded |
| Ot | Ontko clay loam and clay |
| PaB | Polly loam, 0 to 6 percent slopes |
| PaC | Polly loam, 6 to 12 percent slopes |
| PgB | Polly gravelly loam, 0 to 6 percent slopes |
| PgC | Polly gravelly loam, 6 to 12 percent slopes |
| PhB | Polly sandy loam, 2 to 6 percent slopes |
| PkB | Polly sandy loam, thick surface, 2 to 6 percent slopes |
| PkC | Polly sandy loam, thick surface, 6 to 12 percent slopes |
| PlD | Polly stony loam, 6 to 20 percent slopes |
| Pm | Powder loam |
| Pn | Powder fine sandy loam, coarse variant |
| Po | Powder fine sandy loam, over gravel, coarse variant |
| Pr | Powder gravelly loam |
| Ps | Powder sandy loam |
| Pt | Powder silt loam |
| Pu | Powder silt loam, over gravel |
| PvA | Prineville sandy loam, 0 to 2 percent slopes |
| PvB | Prineville sandy loam, 2 to 6 percent slopes |
| PvC | Prineville sandy loam, 6 to 12 percent slopes |
| PwA | Prineville sandy loam, thick surface, 0 to 2 percent slopes |
| PwB | Prineville sandy loam, thick surface, 2 to 6 percent slopes |
| PwC | Prineville sandy loam, thick surface, 6 to 12 percent slopes |
| PxB | Prineville gravelly sandy loam, 2 to 6 percent slopes |
| PxD | Prineville gravelly sandy loam, 6 to 20 percent slopes |
| RdA | Redmond loam, 0 to 2 percent slopes |
| RmA | Redmond sandy loam, 0 to 2 percent slopes |
| RmB | Redmond sandy loam, 2 to 6 percent slopes |
| RnB | Redmond stony loam, 0 to 6 percent slopes |
| RoB | Redmond stony sandy loam, 0 to 6 percent slopes |
| RrC | Redmond very stony sandy loam, 6 to 12 percent slopes |
| Rv | Riverwash |
| Rx | Rock land |
| Ry | Rock outcrop |
| SaB | Salisbury loam, 0 to 6 percent slopes |
| SbB | Salisbury very stony loam, 0 to 6 percent slopes |
| SbD | Salisbury very stony loam, 6 to 20 percent slopes |
| ScD | Searles stony loam, 2 to 20 percent slopes |
| ScE | Searles stony loam, 20 to 40 percent slopes |
| SdD | Searles stony clay loam, 6 to 20 percent slopes |
| SdE3 | Searles stony clay loam, 20 to 40 percent slopes, severely eroded |
| SeD | Searles stony sandy loam, 6 to 20 percent slopes |
| SeE | Searles stony sandy loam, 20 to 40 percent slopes |
| SfD | Searles-Slayton complex, 2 to 20 percent slopes |
| SfE | Searles-Slayton complex, 20 to 40 percent slopes |
| ShD | Slayton channery sandy loam, 2 to 20 percent slopes |
| ShE | Slayton channery sandy loam, 20 to 40 percent slopes |
| SkD | Slayton sandy loam, 2 to 20 percent slopes |
| Sl | Stearns silt loam |
| Sm | Stearns-Crooked complex |
| Ss | Steiger sandy loam |
| Sw | Swartz silt loam |
| Va | Veazie loam |
| Vb | Veazie loam, shallow |
| Vg | Veazie gravelly loam |
| Vr | Veazie-Riverwash complex |

Soil map constructed 1964 by Cartographic Division, Soil Conservation Service, USDA, from 1951 aerial photographs. Controlled mosaic based on Oregon plane coordinate system, south zone, Lambert conformal conic projection, 1927 North American datum.